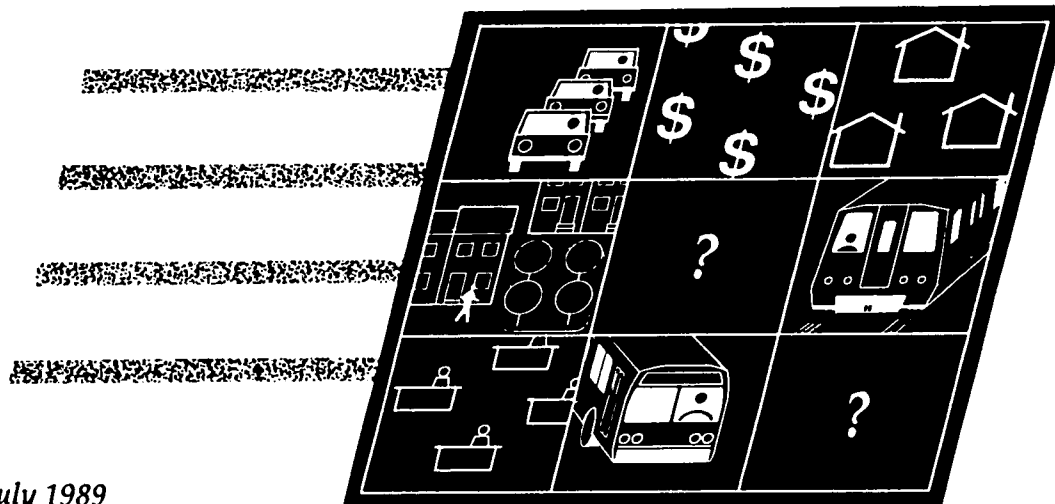


GLOBAL FACTORS:

Assessments and Implications



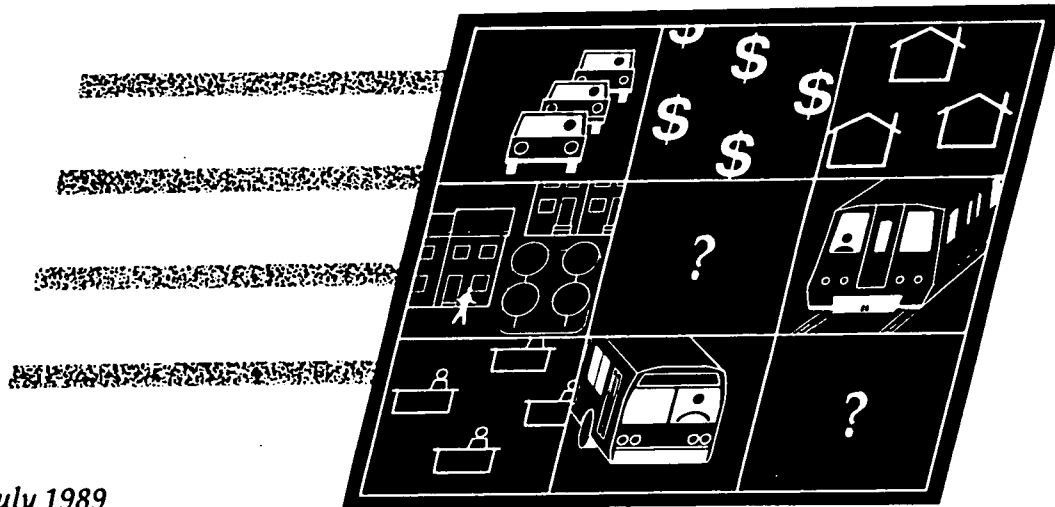
July 1989

Volume 3

*Montgomery County
Comprehensive Growth Policy Study*

GLOBAL FACTORS:

Assessments and Implications



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*Montgomery County
Comprehensive Growth Policy Study*

ABSTRACT

Title: Comprehensive Growth Policy Study
Volume 3. GLOBAL FACTORS: Assessments and Implications

Author: Montgomery County Planning Department
The Maryland-National Capital Park and Planning Commission

Subject: Summary of expert opinion on factors beyond the control of County government, which could affect the outcome of any of the scenarios considered

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Abstract: This document contains a set of papers about factors that operate at global or national scale, but which will influence the future that Montgomery County must face. The papers were prepared by Rivkin Associates, consultants to the Planning Department, who were asked to identify nationally-recognized experts on each topic and, from their insights, summarize the state of current knowledge on these subjects as they may be relevant to Montgomery County. This volume is part of a larger set that comprises the complete study.

The Maryland-National Capital Park and Planning Commission

The Maryland-National Capital Park and Planning Commission is a bi-county agency created by the General Assembly of Maryland in 1927. The Commission's geographic authority extends to the great majority of Montgomery and Prince George's Counties: The Maryland-Washington Regional District (M-NCPPC planning jurisdiction) comprises 1,001 square miles, while the Metropolitan District (parks) comprises 919 square miles in the two counties.

The Commission has three major functions:

- (1) the preparation, adoption, and, from time to time, amendment or extension of the General Plan for the physical development of the Maryland-Washington Regional District;
- (2) the acquisition, development, operation, and maintenance of a public park system; and
- (3) in Prince George's County only, the operation of the entire County public recreation program.

The Commission operates in each county through a Planning Board appointed by and responsible to the county government. All local plans, recommendations on zoning amendments, administration of subdivision regulations, and general administration of parks are responsibilities of the Planning Boards.

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INTRODUCTION

In developing scenarios for the Comprehensive Growth Policy Study, the Montgomery County Planning Department identified factors external to the County's own development process that might significantly influence future land use, economic, and transport patterns.

There are several factors beyond the control of the County government that could influence the outcome of any of these scenarios. The possibility and effect of these factors are difficult to predict because they would result from actions not subject to County government control, such as the actions of national governments, private companies, and consumers. In addition, technological research and invention are factors capable of changing patterns of everyday life, but beyond the control of the County government.

The factors listed here are those currently being considered in the Comprehensive Growth Policy Study. The likelihood and general impact of their occurrence should be assessed during the course of the study.¹

The external factors identified, along with some of the questions raised in connection with each, are as follows.

1. **Air Quality.** What are the prospects for major federal legislation to achieve improved air quality, and how might federal enforcement actions affect County policy to plan and direct transportation and land use?

2. **The Greenhouse Effect.** What is the likelihood of major federal legislation directed toward halting global warming, and what impact might that have on the County's economy and planning for land use and transportation?
3. **Petroleum Dependency.** What would be the impact on Montgomery County of a new petroleum crisis, and how could special High Occupancy Vehicle lanes, transit, and planning for transit serviceability protect the county from adverse impacts?
4. **Private Vehicle Transportation Innovations.** What new technologies are in store for the automobile in the 21st century, and how will these developments affect the fundamental assumptions underlying the County's transportation and land use planning?
5. **Telecommuting and Home-Based Work.** What role will this relatively new phenomenon have in the County's economy, and how will it influence travel patterns, business operations, child-rearing

1 Montgomery County Planning Department, Scenarios as Revised by Council, September 1988, p. 18

or other matters to be considered in the comprehensive planning process?

- 6 **Tiltrotor Aircraft.** What is the probability of tiltrotor aircraft becoming operational for civilian passenger transport within the timeframe of the General Plan, and what factors should be considered in evaluating potential economic and environmental impacts and in selecting sites for tiltrotor facilities?
7. **Major Economic Recession.** How would a major economic recession affect Montgomery County, especially the growth prospects as depicted in current projections, and how well can the County's economy weather such a downturn?

The Planning Department contracted with Rivkin Associates in December 1989 to examine these external factors. The assignment was first to identify nationally recognized experts on each subject who could pinpoint the most current research/resource materials and lead seminars with Planning Department staff. Then, based on scanning the literature, discussions with the experts, and review of available documentation relating to Montgomery County, Rivkin Associates prepared the seven papers in this compendium.

Each paper summarizes the current state of research or thought on the subject and identifies key national issues. Each suggests implications for Montgomery

County's economic development and highlights critical planning issues or initiatives that merit attention in the course of comprehensive plan review. The papers thus provide a useful framework for evaluating the significance of external factors as the review proceeds.

On January 21, 1989, the Planning Department held a day-long series of seminars on the seven subjects with the experts and the consultants. Morning sessions were devoted to the petroleum/automobile/environmental topics, while the afternoon's presentations focussed on national economic recession, home-based work and tiltrotor aircraft. Proceedings were videotaped to permit wider access to the ideas for the Planning Board and staff. Experts who provided resource materials and led the discussions were:

Curtis A. Moore (Automotive Innovation, Air Quality, Greenhouse Effect). Counsel to the Senate Committee on Environment and Public Works since 1978, Mr. Moore has participated in drafting or reviewing every piece of environmental legislation to come before Congress in the last decade. Particularly knowledgeable about the technology, he has written in all three of the subject fields.

Dr. Charles K. Ebinger (Petroleum Dependency). Dr. Ebinger is Group Manager for Energy of the International Resources Group and a Senior Associate at the Center for Strategic and International Studies at Georgetown University. He is the principal author of The Critical

Link: Energy and National Security in the 1980s (Baling, 1982) and a Montgomery County resident.

Thomas E. Miller (Telecommuting and Home Based Work). Thomas Miller is Director of Research, Home Office Research Program, LINK Resources. He is the author of *Telecommuting: Its Potential Effect on Profits and Profitability*, and has since 1985 directed an annual National Work-At-Home Survey which measures the scale of HBW and develops data on the characteristics and composition of the industry.

John F. Zugschwert (Tiltrotor Aircraft). Executive Director of the American Helicopter Society, Mr. Zugschwert is a participant in the joint effort by FAA, NASA, DOD, and the Boeing-Bell consortium to produce civilian tiltrotor transportation by the turn of the century. Both a fixed-wing and helicopter pilot, he is a graduate of the National War College and is a member of the U.S. Defense Science Board.

Dr. Charles W. McMillion (National Recession). A political economist, Dr. McMillion is the Associate Director of the Johns Hopkins University Institute for Policy Studies and was Policy Director and Chief Economist for the bicameral Congressional Competitiveness Caucus. Among his recent publications are two studies for the House of Delegates: *The Maryland Economy: Major Trends* and *Economic Development Resources for Maryland: Assessments and Policy Recommendations*.

All in all, the seminars and the papers which follow concurred, on scanning the horizon, that external factors may bear heavily on how well this community's land use and transportation patterns will serve future economic needs, fiscal conditions, and public health, as well as general quality of life. By grasping the significance now, in the course of comprehensive plan review, Montgomery County can improve its chances for channelling these factors and shaping or cushioning their impacts.

PRÈCIS

Air Quality and Montgomery County

Although air quality has improved significantly over the past decade, pollution is still a serious problem. The Washington metropolitan area has yet to meet Federal Clean Air Standards.

Air quality is linked to the burning of fossil fuels, as are two of the other greatest threats to the United States, petroleum dependency and the greenhouse effect. The Federal government does not recognize this interdependency; any legislation will probably address the three threats independently instead of holistically.

Technology exists to virtually eliminate most common air pollutants, although it's not being used and probably won't be until Federal legislation spurs application of that technology. Congress knows how badly clean air is needed, but fierce controversy has kept legislation from being passed. Within 10-20 years, however, we are likely to have national laws that profoundly affect how people live, work, and travel.

Air quality does not respect jurisdictional boundaries, and, according to the Urban Land Institute, air quality legislation will trigger regional growth management.

The County can try to avoid national and regional control and maintain its independence by managing air pollution locally. There are at least four solutions:

1. Reduce harmful emissions per vehicle. Cars and trucks that get more miles per gallon or use non-polluting power would help solve air quality problems.
2. Use transit and transportation management to get cars off of the road. To be more than marginally effective, this would have to be combined with transit-serviceable land uses.
3. Encourage home-based work to reduce commuting.
4. Use pollution "offset," where a developer offsets the amount of air pollution his project would cause by reducing air pollution an equal amount elsewhere. This could become part of the AGP as public health (including air quality) becomes a limit to growth.

Any County policy that comprehensively addresses air quality, especially one that encourages transit-serviceable land uses, will have to balance conflicting objectives. An appropriate forum for weighing those objectives is the comprehensive planning process, which could also study the interrelationships between air quality, petroleum dependency, the greenhouse effect, and traffic congestion.

The Greenhouse Effect and Montgomery County

When certain gases, many from man-made sources, build up in the atmosphere, they trap the earth's heat, thus raising temperatures and altering the entire world's climate. Most scientists say that the global warming resulting from man's acceleration of this "greenhouse effect" is a severe environmental threat, while others dispute the data showing warming trends.

A major man-made cause of the greenhouse effect is burning gas, oil, and coal; in Montgomery County the main culprit is the motor vehicle. This problem will probably get worse: the number of vehicles registered in the County is forecast to climb from 543,000 in 1986 to over 800,000 in 2010.

Congress has requested major studies from the Environmental Protection Agency and is already introducing and debating bills aimed at controlling the greenhouse effect. One of those bills, co-sponsored by Montgomery County Congresswoman Constance Morella, cuts energy use by: increasing car and truck mileage standards, funding research on solar and other renewable energy sources, requiring state energy conservation plans, setting efficiency standards for Federal buildings, banning non-recyclable materials, and by encouraging tree planting, especially in urban areas. Although that bill probably won't be passed in its present form, some Congressional action is likely.

Most planning issues and potential County policy responses to major congressional legislation relate to the motor vehicle and its impact on patterns of land use and transportation. Fruitful policy goals would be compact, transit-serviceable land uses, energy conservation, and getting people out of individual cars and into busses, trains, and car pools. These measures to control the greenhouse effect are also effective solutions to air pollution, petroleum dependency, and traffic congestion.

Montgomery County's Agricultural Reserve and extraordinary amount of parkland, which protect 40% of the County, significantly contribute to moderating the greenhouse effect through vegetation and trees that absorb harmful gases. Planning policy can further moderate the greenhouse effect with tree protection legislation and by resisting market pressure to develop the wedges with low-density development, which cannot be served by transit and destroys trees.

Petroleum Dependency and Montgomery County

A major public policy issue for the coming decade is what to do about America's increasing dependence on foreign oil.

The U.S. is very vulnerable to oil shortages. We are more dependent on petroleum than other countries are because of our reliance on cars for transportation. In the U.S., 82% of urban person-trips are made by car, versus an average of only 42% by car in 10 other industrialized countries. The federal government has not moved as decisively as other western nations to control automobile use, the primary consumer of petroleum. Only 5% of world oil reserves are within the U.S., forcing us to rely on foreign oil.

The world will run out of petroleum as a source of motive power within a century. In the long term, therefore, alternative vehicle fuels are vital. In the short term, reducing use of petroleum will buffer us from shortages.

What are the implications for Montgomery County? If no petroleum crisis occurs between now and 2010, or if cars that use little or no petroleum become widely used, planning for Montgomery County will have to address the increasing numbers of motor vehicles on the roads. If a crisis does occur, Montgomery County will have to cope.

The County is in a better position to weather sudden gas shortages than are most other urban areas in America. Although the County is decidedly auto-oriented and becoming more so, we have land-use patterns (compact, mixed uses; jobs near housing) that allow non-car travel. We also have better-than-average public transit, and land use and transportation patterns that will support more transit.

Montgomery County can increase its capacity for coping with possible petroleum shortages with public policies that reduce the need to drive cars. The most fruitful planning policy would maintain current patterns of transit-accessible, compact, mixed land uses. This policy would have to buck the current market pressure to spread the hundreds of thousands of new housing units and new jobs expected by the year 2010 throughout undeveloped sections of the County at low densities.

Private Vehicle Transportation Innovations and Montgomery County

A sizable amount of research on automotive technology, spurred by the first 1970s energy crisis, has perfected private cars that get up to 100 m.p.g. of gasoline. Technological advances that increase fuel efficiency, such as continually variable transmissions, are starting to appear on new cars. Several ways to further increase fuel efficiency are being studied, such as less-wasteful engine idling and reduced tire drag.

There hasn't been much change in cars on the road, however, because of low consumer demand for more efficient cars (gas costs are less important than costs of repairs and insurance). The federal government has also reduced m.p.g. standards for new cars. While remarkable increases in fuel economy are within our grasp, pressure to implement them is waning.

All indications are that we will have gas powered vehicles well into the next century. The costs of owning and operating cars are expected to drop while numbers of cars are expected to climb faster than numbers of people.

In Montgomery County, the projection is for more cars that are used more. Two County trends are expected to continue: increasing numbers of multiple-car households, and increasing dispersion of both jobs and homes.

That means more cars, more traffic, more congestion, and more pollution. To deal with such increases, the County needs traffic alleviation measures. We are already using some "administrative" tactics like park-and-ride lots, planning for HOV lanes, and car pool services. Making the physical land use pattern more conducive to alternative commuting will be more effective.

Current County policy regarding transit serviceability is evolving and inconsistent. Policy needs to be more consistent, and transit serviceability belongs in each master plan and sector plan review.

Suggested strategies to enhance transit serviceability are: cluster development around rail stops, retrofit job centers, mix land uses, design new subdivisions to be more transit-accessible, and use a "Transfer of Development Rights"-type program to cluster development in transit-serviceable locations.

Telecommuting and Home Based Work and Montgomery County

The number of people working out of their homes instead of traveling to a workplace every day is rising rapidly, and the future growth potential is great. There are essentially four kinds of people working at home: home business operators, freelancers, corporate employees working after hours at home, and established corporate telecommuters.

Telecommuting and home based work can reduce traffic and alleviate congestion, improve air quality, and save money on offices and related services. The potential to reduce congestion is so great that California has started an experimental program using home based work with a target of removing three million car trips from Los Angeles by the year 2010.

In Montgomery County, home based work is appealing as a planning option. It's also appropriate for County workers, who fit all the profiles of home based workers. A preliminary study of new employment in Silver Spring estimated that encouraging home based work would reduce peak hour vehicle trips between 3 and 10 percent.

The Federal government, Montgomery County's largest employer, is a prime candidate for a telecommuter program because of its current mandate to lower office costs and to reduce the amount of office space per employee.

A large number of home based workers on the County would cause negative effects, too. Office construction would decline, costing the County millions of tax dollars. The County would also lose other business-related taxes. Overall, there is not enough data to say whether Montgomery County would win or lose.

Neighborhoods could change if many people telecommuted or worked in cottage industries. There would be more people around during the day, more traffic through the neighborhoods, and prices could rise as people had extra income to spend on a house.

The County is now examining zoning regulations on home employment. Potential neighborhood changes in the event of a large increase in home based work make the ongoing zoning revisions especially important.

By the year 2010, 20 percent of the workforce could be telecommuting or working in home based businesses. This is a major trend for the comprehensive plan to review. Currently there is no information on the subject, but pertinent questions can be included in the County Office of Management and Budget's resident survey, M-NCPPC's EMME2 calibration study, or MCDOT's transportation demand management program.

Tiltrotor Aircraft and Montgomery County

Tiltrotor aircraft, a hybrid between helicopters and airplanes that takes off vertically and carries as many people as a bus, doesn't need major airports or runways. This fast, agile, and mechanically uncomplicated aircraft offers a solution to one of the most serious public facility problems of both the U.S. and western Europe: airport congestion. U.S. armed forces and civilian aircraft companies are working together to develop functional tiltrotors. According to their published timetable, the military will begin using tiltrotors in 1992, and commercial passenger service will start sometime between 2000 and 2010. It seems clear that tiltrotor shuttles will be flying between Washington, D.C., and New York City by 2010.

Will there be a market demand for "vertiports" in Montgomery County? Government and industry see the main commercial application of tiltrotors as business travellers, and a principal market as the corridor between Boston and Washington, D.C. Studies predict the largest numbers of riders in the Washington metropolitan area will come from northern Virginia and downtown D.C., although Montgomery County is also a logical place for a vertiport.

What kind of a site would be best for a vertiport in Montgomery County? To attract the most riders, a good site should be close to Bethesda, Northwest D.C., and the I-270 corridor, and be accessible by Metrorail and the Interstate highway system. About 5-12 acres are

needed; more than half of that will be for parking. Tiltrotor aircraft are much quieter and safer than helicopters, but the noise levels adjacent to a vertiport are still too high for a residential area. Suitable neighbors for a vertiport are commercial and industrial uses. The area south of I-370 near the Shady Grove Metro station seems ideal.

One way to have a vertiport ready and waiting when commercial service becomes feasible is to build a heliport that can also accommodate tiltrotors. That may be a particularly good idea for Montgomery County as a helicopter base is needed in the Shady Grove area by 2010.

The Metropolitan Washington Council of Governments is thoroughly investigating tiltrotor facilities, including combined helicopter/tiltrotor ports.

Economic Recession and Montgomery County

Although economic predictions for the country in general range from dire to rosy, there is general agreement that hard times are coming, and they are expected to last at least through the early 1990s.

Montgomery County will probably have an economic recession at the same time the rest of the country does. This recession may be a little longer and deeper than other lows in the County's economic cycle since the 1960s, but the region's overall trend of economic and population growth is not expected to change. What will drop is the rate of growth.

There are two other possible causes of growth slowdowns in Montgomery County. One is a large cutback in Federal spending. The other is the County's labor supply, housing supply, and transportation facilities not being able to support continued growth at a rapid rate.

The County is in a very good situation to deal with economic dislocations, thanks to a diverse economy and the Federal government's steadying influences of a relatively consistent payroll and support of high-tech industry. The Federal government is the County's largest employer and a strongly-felt economic presence, although Montgomery County is less dependent on the Federal payroll than other jurisdictions in the metropolitan area are. The County's economic cycles fol-

low both national business cycles and Federal spending cycles.

Growth management tools such as the APFO have strengthened the County's recession resistance by keeping the County's budget from becoming overextended on infrastructure costs and by preventing serious overbuilding of office and commercial space.

If Montgomery County does have a recession, several impacts can be predicted. Taxpayer revolts are likely, and County expenditures will drop, although the tax base and total personal income will still rise slowly. Capital spending constraints will call for more efficient use of roads and utilities, such as clustered, transit-serviceable development and use of transit and ridesharing. The General Plan's efficient pattern of clustered development will be even more apropos.

The office market will slow, but losses in some sectors will be offset by gains in others. Drops in employment will lead drops in housing construction. The housing shortage will continue, especially for lower-cost housing. House prices won't drop significantly without a real depression. Lower incomes probably won't put many people out on the street: families will cope by taking in boarders and by sharing houses, and people will piece together supplementary income.

Chapter 1

Air Quality and Montgomery County

[REDACTED]

[REDACTED]

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AIR QUALITY AND MONTGOMERY COUNTY

Primary Sources

Environmental and Energy Study Institute, *Special Report, Briefing Book, Environmental Energy and Natural Resources Issues*, Washington, D.C., 1988

James J. MacKenzie, *Breathing Easier: Taking Action on Climate Change, Air Pollution, and Energy Security*; World Resources Institute, Washington, D.C., 1988

Curtis Moore, *Here are The Answers* (draft unpublished ms), Washington, D.C., 1988

Introduction: The Linkage Factor

Americans have a way of compartmentalizing thought in the face of issues that may be too large or complex to grasp. When institutional mechanisms do not exist to address a problem in all its dimensions, we tend to deal with part by by component part. Such is the case with the human and environmental impacts from consumption of fossil fuels.

Despite conservation successes of the 1970s and early 80s, both oil imports and gasoline use are on the rise. Automobile ownership is up, engendering congestion levels not amenable to relief by the limited road budgets of state and local jurisdictions. (Between 1980 and 1986, the greater Washington area added more

vehicles — 575,000 — than people — 324,000¹.) Vehicle emissions are a significant — although not the only — causes of ozone and carbon monoxide which characterize the region's major air pollution problems. Vehicle emissions are also the largest single source of nitrogen oxides and organic compounds, major contributors to the gaseous brew that produces global warming. What vehicles don't generate, power plants do. Taken together, transportation and electric power generation from fossil fuels comprise the predominant sources both of air pollution and the Greenhouse Effect.

An increasing number of "experts" have begun to see the linkages.

Three of the most serious, long-term challenges the United States faces today are:

climate changes, which could influence virtually every aspect of national life

persistent air pollution; and

growing dependence on imported oil, which in 1987 cost us over \$40 billion.

Although U.S. lawmakers and government agencies are treating these problems separately, they are really three facets of the same problem. And the closer

1 Greater Washington Research Center, *Cars Overtake People*, March 1988

we look the clear it becomes that we will not be able to solve any of them piecemeal, at least not without aggravating one or both of the others.

The threats posed by greenhouse warming, air pollution, and oil imports are all intimately linked to energy use, mainly fossil fuel combustion.²

Local communities, such as Montgomery County, experience the full force from the combined impacts of fossil fuel consumption: traffic congestion; air pollution and associated environmental degradations. Nationally, however, the issues are viewed in compartments, within the framework of what Curtis Moore, General Counsel to the Senate Committee on Environment and Public Works, calls "artifacts" of traditional limited purpose legislation. Thus, Congress is looking separately at the "Air Pollution" problem, the "Greenhouse Effect" problem, and the "Energy Sufficiency" problem. Unless this policy context changes, major new federal initiatives will be individual programs targeted on these individual "problems," although all will ultimately affect how and how much we continue to depend on fossil fuels.

Air Quality

This report addresses the "air pollution" component of the problems. From the standpoint of air pollution,

arecent issue paper summarizes the Environmental Protection Agency's assessment:

Air quality has improved greatly over the past decade, but pollution problems remain widespread. . . The following improvements in national average air quality levels from 1977 to 1986 were reported.

Carbon monoxide levels improved 32 percent, and the estimated number of exceedances of the 8-hour standard decreased 89 percent.

Sulfur dioxide levels improved 37 percent, and the estimated number of exceedances of the 24-hour standard decreased 98 percent.

Nitrogen dioxide levels improved 14 percent.

Particulate levels improved 23 percent.

Lead levels improved 87 percent.

The report said that ozone levels improved 13 percent between 1979 and 1986, and that the estimated number of exceedances of the standards decreased 38 percent.

EPA considers ozone the most widespread and intractable problem. In 1986, 75 million people lived in counties with ozone levels that exceeded the air quality standard. . .³

2 James J. MacKenzie, *Breathing Easier: Taking Action on Climate Change, Air Pollution, and Energy Insecurity*, World Resources Institute, Washington, D.C., 1988, p. 2

3 Environmental and Energy Study Institute, *Special Report Briefing Book*, Washington, D.C., 1988, p. 10

The Natural Resources Defense Counsel depicts ozone as:

Ozone smog is formed by the action of sunlight on volatile organic chemicals (also called hydrocarbons) and oxides of nitrogen (NO_x) emitted from motor vehicles oil and chemicals producing and using facilities, power plants, and other commercial and industrial emission sources. (Ozone smog, which is harmful, should not be confused with the protective layer of ozone in the atmosphere)⁴

Air pollution does not respect jurisdictional boundaries. Montgomery County's air floats in with pollutants generated elsewhere and floats out with what we emit here. Washington's air quality management district is on the list of areas that have failed to meet Federal Clean Air Standards. Ozone levels and other air pollutants are somewhat less out of conformance with the law than in auto-dependent cities subject to air inversions, such as Houston or Los Angeles. But the distinction may be between toxicity and downright hazard.

EPA sets a national standard of .12 parts per million, and under Clean Air Act regulations an area can exceed this level once per year to be in compliance. According to a COG report in early 1988:

In the first six months of 1987 we exceeded the standard four times, with several violations at their highest levels since 1985. In 1983, which was a particularly bad year, the region had 99 violations of the ozone standard. While violations have dropped significantly since then, it's clear that we are not really close to meeting the ozone standard. . . Episodes of four days with high ozone readings typically occur in the metropolitan Washington area once or twice each year.⁵

That report was written before the summer of 1988. The drought and heat wave across the U.S. have encouraged NRDC and other environmental groups to lobby EPA and Congress for tighter ozone standards, as low as .08 parts per billion, in the interest of protecting public health. NRDC arranged monitoring of the Washington Metropolitan Area during the summer of 1988 and concluded:

Ozone air quality was terrible in the Washington area this past summer. As an example, in July only five days could be classed as "clean."

Six days were moderately polluted, seven additional days were heavily polluted and thirteen additional days were so polluted they would violate occupational health rules inside factories.

4 Natural Resources Defense Counsel, "The Dangers of Ozone Smog: New Scientific Evidence Shows Need for Stringent Controls," Washington, D.C., 1988, p. 1

5 Stuart Freudberg and Robert Kaufman, "Ozone: Our Worst Outdoor Pollutant Still Lingers," Metropolitan Washington Council of Governments, 1988, p. 4

In all, 26 out of 31 days in July were polluted for eight or more hours a day. This repeated pollution exposure poses a significant health threat, especially for children, the elderly and those with impaired breathing ability.⁶

Only one of the monitoring stations was in Montgomery County, in Rockville. Results showed that from May through August, there were 13 days when the maximum one hour average exceeded .12 and 32 days when the maximum eight hour average exceeded .08, better than the regional figures but no cause for complacency.

Technology in Hand

Curtis Moore and other experts believe the technology is in hand to eliminate or to reduce well below current levels ozone smog, acid rain, carbon monoxide and other air pollutants. Moore identifies the options as ten steps towards "zero pollution" in a draft paper:

Step One

Switch to natural gas—it really is cleaner. Experts agree that burning natural gas instead of coal cuts all three of the critical air pollutants: sulphur dioxide, which causes acid rain, drops 99 percent; oxides of nitrogen, which causes ozone and acid rain, is cut by a third; and carbon dioxide, the Greenhouse pollutant, by one-half. Burn the gas in one of the "super turbines" from General Electric or Mitsubishi and powerplant efficiency climbs to over 50 percent, cutting air pollution still further.

If you want to see it, go to...
Greenville, South Carolina
Tokyo, Japan

Step Two

Don't want to burn natural gas? Then burn coal efficiently. New technologies make it possible to burn even dirty coal very cleanly. Switching to one of these — pressurized fluidized bed combustion, for example — cuts sulphur pollution by 94 percent and oxides of nitrogen by 30 percent.

If you want to see it, go to...
Stockholm, Sweden
Spain
Brilliant, Ohio

Step Three

Cleanse the stack gases. Add-on pollution controls cut sulphur dioxide and oxides of nitrogen by 90 percent. One of these, selective catalytic reduction, has been installed on about 400 powerplants everywhere from Japan to Austria — but barely anywhere in the United States or Canada.

If you want to see it, go to...
Ventura County, California
Vienna, Austria
Gelsenkirchen, Germany

Step Four

Don't waste the heat. Instead of burning fuel in one place to generate electricity and another to heat

6 NRDC, op. cit., unnumbered page

apartments or run a pulp and paper mill, combine them. Using the heat which would otherwise go up the smokestack boosts total efficiency to 85 or 90 percent, dropping air pollution — especially the hard-to-control carbon dioxide — by another 40 to 50 percent.

If you want to see it, go to...
Minneapolis, Minnesota
Stockholm, Sweden

Step Five

Buy a better car. Until car makers are required to improve all cars, shop around for those that burn the least gas. A five mile-per-gallon improvement cuts carbon dioxide pollution from just the cars in the United States by roughly 190 billion pounds a year.

If you want to see it, go to...
your local car dealer

Step Six

Build a better car. Cars that will run 100 miles per gallon have been built, driven, tested, and approved by the government, but they're now sitting on the shelf. Build, buy and drive them and carbon dioxide from cars will be cut by up to 70 percent, according to data compiled by OTA.

If you want to see it, go to ...
Toyota City, Japan
Goteborg, Sweden

Step Seven

Build better homes. Experts estimate that replacing the current generation of energy-hungry furnaces, hot

water heaters, air conditioners, light bulbs and toaster ovens would cut energy, household energy consumption — and air pollution — by 50 to 66 percent. The replacement appliances all exist and can be bought off the shelf. Just look

If you want to see it, go to...
Sears, Montgomery Ward, or other
local appliance dealers

Step Eight

Remember Johnny Appleseed. A single fast-growing tree such as a willow or a sycamore will consume 20 to 40 pounds of carbon dioxide a year. It's not much — 20 pounds is roughly one gallon of gasoline — but every little bit helps.

If you want to see it, go to...
Your local garden store or nursery.

Step Nine

Curtail industry consumption. U.S. industries gobble twice as much energy per unit of production as their Japanese counterparts, according to the World Resources Institute. Put them on a par and air pollution is cut by 50 percent.

If you want to see it, go to...
Ougishima, Japan

Step Ten

Develop and adopt solar electricity, "zero risk" nuclear, or "Hydrocarb" refined coal. For the moment, hydrogen appears to be the perfect fuel: it can be produced by running electric current through water or it can be refined from coal and, when burned produces only

water and a vanishingly small amount of oxide of nitrogen. Cars can run on hydrogen and so can power plants. The electricity can come from a dozen or more zero-pollution technologies: solar; geothermal; hydropower; tidal power; wind power; and ocean heat pumps, to name but a few. If you have faith in nuclear, the electricity can be provided by the new generation of "inherently safe" plants.

If you want to see it, go to...
Daggett, California (solar)
Singapore (ocean thermal energy)
Stockholm, Sweden (ocean heat pump)
Japan (geothermal and solar)⁷

Although experts may differ as to which technologies are most productive, they generally agree that political measures (e.g., federal legislation) will be needed to re-assert priority for air pollution control so that pressure to introduce the technology can build momentum.

As we have noted in the Petroleum Dependency paper, with the price of gasoline remaining low, little external pressure is being exerted on Congress to limit petroleum use, despite rising oil imports. As we also note in the Automobile Innovations paper, fuel efficiency standards have been relaxed. Despite the events of the summer of 1988, concern for air quality has not been sufficient to force tightening the ozone standard. This drift of purpose was reflected in the

100th Congress' performance regarding air quality legislation.

The 100th Congress put a major effort into revising the Clean Air Act, but the legislation died amidst fierce controversy over each of the three main areas of debate — ozone and carbon monoxide pollution, acid rain, and toxic air pollution. . .

All sides agree that legislation is needed, but there is much controversy over which pollution sources should be targeted for additional controls. Industry says many of the controls favored by environmentalists would not produce enough health benefits to be worth the cost. Another major issue is to what extent Congress should mandate particular control measures rather than leave decisions on how to control pollution to EPA and states.⁸

Unclear Prospects

Any prediction about the 101st Congress must be speculative. An inquiry to the office of Rep. Henry Waxman, Chairman of the House Energy Subcommittee on Health and the Environment, drew the response that it is too early to tell about this term's strategy on a renewed Clean Air bill effort. Energy Committee Chairman, John Dingell, blocked acid rain legislation in the last session and remains a potent force. David Gushee of the Congressional Research Service believes that if there is legislation, it will probably focus on stationary sources (power plants

7 Curtis Moore, *Here Are The Answers*, draft unpublished ms, 1988, pp. 13-15

8 EESC Briefing Book Issue Paper, op. cit., p. 11

and major industries and their contributions to acid rain), leaving EPA to deal directly with the states on matters relating to indirect sources, ozone standards and tighter air quality management plans — which affect local area land development and transportation.

One sensitive topic which might be resolved by legislation or EPA is the issue of controlling vapor from motor vehicle fuels which affects ozone levels.

One divisive issue is whether gasoline vapors from refueling of vehicles should be controlled by installation of "stage II" controls at gas station pumps or by canisters on board motor vehicles to capture the vapors. The oil industry opposes stage II; the auto industry opposes on-board controls. The National Clean Air Coalition and a group representing state air officials says both should be required. EPA has proposed regulations that would require on-board canisters and says the decision on whether to require at-the-pump controls should remain with the states.⁹

Efforts to grapple with the national deficit could act as a surrogate air quality measure, if — as now frequently discussed in the press — a substantial gasoline tax is imposed. A higher gas tax might introduce an economic imperative among some consumers to conserve fuel. That might accelerate introduction of higher mileage and less polluting vehicles, apart from any tightening of emissions standards.

Over the long run, however, the air pollution issue will not disappear. Whether legislative efforts will be successful in the 101st Congress or the 110th, or accrue incrementally, it seems clear that the Federal Government — through acts of Congress and EPA's administration — will tighten controls on direct and indirect sources of pollution. Ozone and carbon monoxide are not yet things of the past. Within a 10-20 year time frame local jurisdictions will likely face national sanctions that profoundly affect how their citizens live, work, and travel.

Implications for Montgomery County

Three other papers in this series deal with environmental issues. Those on automobile innovations and petroleum dependency highlight planning options which Montgomery County could consider unilaterally to address the challenges. These are options which can maintain advantages Montgomery County has in relation to other suburban jurisdictions or enhance the County's position. Some of the same options could be invoked to meet stricter air quality standards and are cited below.

If the Federal Government were to crack down on air pollution (or address the Greenhouse Effect), a somewhat different dimension of sanctions might be introduced. Here, the prospect of state or regional controls

9 Ibid., p. 11

over how an individual community regulates its land use and mobility patterns looms large indeed, and is related to our earlier reference that air pollution does not respect jurisdictional boundaries.

One concerned group is the Urban Land Institute. Douglas Porter, ULI's Director of Research, believes that serious efforts to counter air pollution will threaten to encroach on home rule powers of individual jurisdictions and will drastically change the way we plan and build communities. He sees growth management on a regional basis as an inevitable outcome. ULI is sufficiently concerned to schedule a February 1989 workshop in Washington, featuring a planner from Los Angeles where region-wide planning in response to EPA's pressure for air quality improvement is far advanced.

For Montgomery County, one direction from which stricter regional sanctions could come is the State of Maryland. EPA requires State Implementation Plans, and Maryland's could impact strongly on a community's planning, zoning, and transportation management policies. But this appears less likely than impetus from the County's regional air quality management district which includes Washington and its suburbs. Boundaries of this district are likely to be expanded to include all of COG's member jurisdictions.

An option for the Washington Region, which includes portions of two states plus the District, could be a

regional air-quality compact. Any such inter-governmental agreement, or strengthened state control, would raise political issues in all the jurisdictions — but may well be on the horizon. Stuart Freudberg, COG's air quality director, believes no one knows what Congress and EPA will do. However, the metropolitan area's communities, individually, jointly, and voluntarily can initiate stronger air pollution control efforts on their own to avert federal intervention. In other words, the strategy of choice appears to be one of getting a good faith effort underway here as a means of holding off such drastic possibilities as an EPA-imposed construction ban and other sanctions such as California faces.

Under any circumstances, county planning policy would need to address a number of considerations as the result of tougher enforcement of national air quality standards.

The Minimal Prospect — Stage II Vapor Recovery

One likely outcome is adoption of Stage II vapor recovery either through legislation or EPA enforcement. If recovery mechanisms are installed on vehicles at the time of production, this would mean some increase in the cost of a car. A more likely scenario is that devices will be mandated at filling stations, similar to those now required by the District of Columbia. Dr. Eric Mendelsohn of MCDEP estimates an installation cost of \$20,000 per station, and annual maintenance at \$8,000.

The Annapolis legislature has forbade Maryland DEP to impose the requirement, but individual communities may be able to do it. Fairfax County is actively considering such a measure. The Commission on the Future recommended Montgomery do so as well. While this would raise the price of gas, it probably would have negligible impact on the County's land use or transportation conditions.

Alternative Fuels

In 1988 Congress passed an alternative fuels act which provided incentives to manufacturers for producing vehicles which run on mixtures of ethanol/methanol and gasoline. Special incentives are available for fleet vehicles, such as police cars, to switch. An UMTA grant, for example could afford an option for Montgomery County to buy new school buses, Ride-ons, police cars, etc., that use alternative fuels. But the jury is still out on whether alcohol-based fuel is indeed less polluting or, if widely used, would make the U.S. more energy independent.

The widespread substitution of alcohol fuels (especially methanol) for gasoline or diesel fuel is being proposed in some quarters, but for several reasons this does not seem wise. The United States does not have nearly enough domestic natural gas resources — the cheapest source for making methanol — to make the methanol needed to substitute for oil in the U.S. transportation system. And importing

methanol on a large scale does not make much sense since this merely substitutes one form of energy dependence for another. Finally, there are still uncertainties as to whether methanol vehicles will decrease, or actually increase, urban smog formation. . . .

. . .there is limited research on the problem. The two most promising candidates are electric and hydrogen-powered vehicles. Introducing such inherently clean vehicles — with the hydrogen or electricity derived from non-fossil energy sources — would cut urban air pollution, acid deposition, climate change, and foreign oil dependency down to size.¹⁰

If electric powered or hydrogen vehicles were brought on line before 2010, Montgomery County's air would become a lot cleaner, but traffic congestion would be no less.

A Fuel Efficiency Crackdown

The Federal Government could set higher fuel efficiency standards and/or taxes on vehicles that did not meet the standards. Technology is available to produce less polluting vehicles which could achieve performance of 50-60 mpg or more. More stringent federal controls would accelerate their introduction.

Such measures would clearly reduce air pollution, if buyers chose these vehicles, but would have little

10 James J. MacKenzie, op. cit., pp. 18-19

long-term effect on the number of vehicles in use by County residents or commuters to County employment areas from outside. Based on Montgomery County's present per household levels and the COG intermediate household forecasts, the number of motor vehicles in the County would increase from 543,000 in 1986 to over 800,000 in 2010. This does not account for commuters from outlying jurisdictions to the County. If the jobs/housing gap grows, the commuters from outside would increase disproportionately. The net effect could be a marked reduction in air pollution, but an overwhelming impact on the County's road system.

Transit and Transportation Management Options

If automobiles proliferate to an unmanageable degree and/or if an energy crisis looms, the County will need to maximize use of public transit, paratransit (such as neighborhood jitney service) and transportation management measures, to reduce automobile flow. It will be precisely the same situation in the event of an air quality crackdown — again an indication of how County policies to address one set of external factors may be identical to those needed for others.

Montgomery County's resident transit usage for work trips (12 percent) is four times as high as the Los Angeles suburbs and still higher than what Los Angeles hopes to achieve by the year 2000 with an extraordinary array of transportation management measures.

The County is in an excellent position to build on this base. But a 12 percent level (if sustained) will not be sufficient to deal with the probable scale of increased auto usage, an energy crisis, or air pollution. Rather than reiterate the discussion in the accompanying papers, we list the possibilities: light rail service north from Shady Grove and on the Georgetown Branch; HOV systems on I-270, Route 29, and the Intercounty Connector; a denser network and closer scheduling of Ride-On Service; and an array of transportation management measures from parking taxes to transit subsidies. Many appropriate transportation management measures are identified in the more than 50 recommendations that appear in the *FY 88 Annual Growth Policy's* supporting document *Alternative Transportation Scenarios and Staging Ceilings* and are incorporated here by reference.

It is good to point out, however, that management measures, without attendant policies to make the County's residential neighborhoods and employment centers more transit serviceable (thereby generating passengers for alternative transportation) could have limited effects on air quality. David Gushee, Senior Specialist in Environmental Policy for the Congressional Research Service, cautions about the effectiveness of management measures alone, after a national review of TCMs (transportation control measures) currently in operation:

TCMs require major investments of institutional time, talent, and management. They are immensely detailed. They deal with each major employer in the

planning area for work schedules, carpooling programs, and incentive programs for employee use of public transit. They deal with red light synchronization on dozens of main arteries, and congestion at hundreds of intersections. They address bus routes and schedules, bicycle lanes, shopping center layouts, transportation networks, sites and institutional arrangements for fringe parking, and various ways to entice people out of their cars (trip reduction ordinances, for example).

These efforts consume staff time, which consumes money. Yet each time consuming individual initiative contributes an unmeasurable, but usually almost infinitesimal benefit in emissions reductions while often at the same time working against the natural inclinations of the affected individual citizens.¹¹

Transit Serviceability — the Policy Imperative

Accompanying efforts to increase transit use could be planning and zoning policies that:

maintain or build upon the strengths of neighborhoods and planning areas that are transit serviceable today.

establish guidelines which encourage planning areas where new development will occur to evolve at higher than currently-planned densities and become transit serviceable.

Discussion in the Automotive Innovation paper (from page 10) relates to these policies and what we term Montgomery County's uphill battle to achieve greater transit serviceability. We examine the present pattern of multiple-car ownership and transit use within the County and cite several promising approaches from concentration of growth near Metrorail and new light rail stations, to improved subdivision design that permits High Occupancy Vehicle access. We also highlight policy issues to be considered. These issues range from limited land availability in some areas, to market forces which militate against concentration and higher densities, to citizen opposition to infill and higher density development. We indicate that the comprehensive planning process is an appropriate forum for weighing and balancing conflicting objectives, one of which — in terms of this discussion — may well be air quality.

Home-Based Work and Telecommuting

Yet another paper in our compendium examines the prospects for increased Home-Based Work (HBW) including telecommuting. HBW appears to be a likely prospect for many more County residents, for people employed in the County who live elsewhere, and for people who drive through from homes on one side of the County to jobs on the other. One effect of HBW could be to reduce potential commuting traffic on

11 David E. Gushee and Sandra Sieg-Ross, *The Role of Transportation Controls in Urban Air Quality*, Congressional Research Service, 1988, p. 26

County roads and thereby improve both air quality and congestion. If, for example, 40,000 County jobs were held by new home-based workers in the year 2010, daily peak period trip savings of more than 19,000 could conceivably be effected. We would need to know, however, where these individuals lived and the locations and where and how they would otherwise travel to work to gauge the impact of trip savings. The greater dispersion of jobs and housing, the less will be the effect on reducing congestion. To the extent that total mileage driven is reduced, however, by removing some of the longer distance commutes, air quality will benefit more.

No existent database depicts the present extent and location of HBW in Montgomery County. The paper recommends priority to such data gathering, along with a pilot project in a CBD (Silver Spring) to identify the extent to which HBW could help meet trip reduction goals.

The Pollution Offset Concept for Major Development

The County could consider the pollution "offset" concept for major development as an addition to its land use regulatory structure. In principle, the idea is similar to that used by the Corps of Engineers and state government in permitting development on wetlands. Development on wetlands is allowed under certain circumstances, but applicants must replace the proposed amount of drained land with new wetlands created elsewhere on the property.

Major development — industrial parks, shopping centers, mixed-use projects, large scale subdivisions — does engender pollution (as well as traffic), the extent of which can be estimated on the basis of proposed use and space quantities and an evaluation of the site location. What if developers were required to undertake pollution-reduction measures that matched the scale of the likely additions?

The measures could vary, and would have energy efficiency and traffic reduction implications as well. For example: installation of co-generation electric power and heating/air conditioning plants in large scale mixed-use projects. Moore contends that co-generation can reach energy efficiency levels of 80-90 percent, while reducing electricity consumption and escaping gases. Federal legislation (PURPA), moreover, requires power companies, such as PEPCO, to purchase any excess power produced from private co-generation plants. Georgetown University's new electricity/heating/air conditioning system is an on-campus co-generation facility that is a DOE demonstration project. At least one private co-generation plant now operates within the County (at GEICO).

This approach could be applied to new high density and mixed-use facilities at transit stations and other nodes of growth, and might be utilized for large scale projects to redevelop CBDs within the 2010 time period. Formulation of co-generation guidelines in conjunction with the MXP zone was proposed in the

County's draft 1988 Comprehensive Energy Plan. It could apply to a broader mix of zoning categories, if air pollution control became a significant concern.

Other measures might involve requiring applicants to install high efficiency furnaces, electric equipment, and building materials in new housing and office complexes — or jitney services between new residential developments or office complexes and the nearest Metrorail station. (A developer-sponsored jitney connects Bay area BART stations with Pleasanton, California's Hacienda Business Park.)

The offset concept could be introduced in the zoning ordinance and/or as part of annual growth policy review. At present, schools and transportation are the key ingredients in the AGP. It is conceivable that public health (air quality) may one day become yet another limitation on growth. In the same way that the AGP permits developers to stipulate traffic mitigation programs (removing as many trips as they generate beyond the ceiling), Montgomery County could consider pollution-removal incentives as a component in development approvals.

Concluding Note

Other than PEPCO's Dickerson Power plant and the proposed County Incinerator at the same location,

Montgomery County does not have — nor is likely to have — the large generating complexes and major industries that fall under the heading of stationary sources. Emissions from stationary sources are controlled by federal and state governments today and will continue to be so. Montgomery County's air pollution generators are primarily indirect sources: buses, automobiles, shopping centers and industrial parks, housing developments. Major new federal initiatives to improve air quality could encroach on local authority to regulate these land uses and their attendant transportation flows (as happened with stormwater and wetlands management) and shift power to state or regional bodies.

Whether Montgomery County's autonomy is reduced or not, the County can begin to establish planning policies which will contribute to clean air here and in the region as a whole. Most of these policies will be identical to those which can protect our economy in the event of an energy crisis and can cope with the automobile itself if — as the predictions indicate — vehicle use proliferates well into the 21st century. Understanding of these linkages, and the multiple justifications for the policies, could evolve in the process of comprehensive plan review.

Chapter 2

The Greenhouse Effect and Montgomery County

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THE GREENHOUSE EFFECT AND MONTGOMERY COUNTY

Primary Sources

James J. MacKenzie, *Breathing Easier: Taking Action on Climate Change, Air Pollution, and Energy Insecurity*, World Resources Institute, Washington, D.C., 1988

U.S. Environmental Protection Agency, *The Potential Effects of Global Climate Change on the United States*, Draft Report to Congress, Executive Summary, 1988

The Hon. Claudine Schneider, "Global Warming Prevention Act": The Congressional Record, Vol. 134, No. 141, October 6, 1988

Introduction

Four papers in this compendium about external factors that may affect Montgomery County's long-term planning deal largely with fossil fuel. The petroleum dependency paper examines potential impacts of another oil crisis. The automotive innovations paper evaluates the significance of vehicle ownership rising to over 800,000 by the year 2010, whether or not an oil crisis occurs. The review on air quality discusses implications for County planning policy in the event Congress cracks down with toughened legislation and enforcement on air pollution. We have prepared this paper on the Greenhouse Effect last in the series for two reasons:

1. Practically all of the planning issues — and potential County policy responses — in the event of major congressional legislation directed at containing the Greenhouse Effect are identical to ones discussed in the other three papers. They relate to the motor vehicle and its impact on shaping the County's patterns of land use and transportation.
2. While Montgomery County's response to the automobile, along with other policy options towards energy and greenspace conservation discussed below, will in the long term determine the extent to which this community generates greenhouse gases, the "problem" is the least amenable of the four to local initiatives. Global warming is indeed global, requiring coordinated responses of many nations before it can be safely put to rest. Our air quality review stressed that regional considerations would ultimately determine the safety of Montgomery County's air. In terms of the Greenhouse Effect and its impact, even nationwide measures to control fossil fuel consumption and engage in reforestation represent only partial solutions.

The Problem and Its Scale

James MacKenzie describes the Greenhouse Effect and its significance as follows:

When certain gases — mainly carbon dioxide, ground-level ozone, chlorofluorocarbons (CFC's) and halons, methane, and nitrous oxide — build up in the atmosphere, the so-called greenhouse effect occurs. . . These greenhouse gases trap some of the heat (infrared radiation) the earth emits, increasing the earth's surface temperature and altering the global climate and all the natural and human activities that depend on it.

(The earth has long experienced a greenhouse effect from naturally occurring levels of carbon dioxide and water vapor. Without this natural greenhouse warming, the earth would be about 60 degrees F cooler than it is, and life on earth, as we know it, would not be possible.)

Great uncertainties surround the exact consequences of the extra global warming from the build-up of greenhouse gases, but it could well pose the greatest environmental threat in history.¹

MacKenzie indicates that carbon dioxide emissions have increased as a function of fossil fuel consumption and that deforestation — primarily in third world countries — has added about one-fifth as much. Other contributing gases have been the same ground-level ozone which causes air pollution, the concentrations of which have doubled worldwide in the past 100

years. He cites increasing methane concentrations, nitrous oxide from fertilizers and fossil fuel combustion, the CFCs and halons that are used in refrigeration, air conditioning and aerosol cans, as additional contributors to the mixture of gases attacking the earth's atmospheric ozone layer.

Clearly, carbon dioxide is not the only villain in the atmospheric upset now under way. Together these other gases are contributing about as much as carbon dioxide to global warming.²

In terms of the United States, the principal sources of ozone and acid rain which characterize air pollution as well as greenhouse gases are power plants and vehicles — both of which consume fossil fuel.

The gas resulting in ozone and acid deposition — so called precursors — have many sources, mainly related to fossil fuel combustion...Electric power plants — mostly coal-fired — emit about two-thirds of all sulfur oxides. Vehicles are the single largest source of nitrogen oxides (41 percent) followed by power plants (29 percent) and other combustion processes.³

As long as electricity use continues to increase in the United States, as long as electricity is

1 James K/ McKenzie, *Breathing Easier: Taking Action on Climate Change, Air Pollution, and Energy Insecurity*, World Resources Institute, Washington, D.C., 1988, p. 4

2 Ibid, p. 6

3 Ibid, p. 13

generated mainly from fossil fuels, and as long as oil consumption for transportation grows in the absence of practical alternatives to the oil-based internal combustion engine, electric power production and transportation will remain the two most important sources of carbon dioxide emissions. And without dramatic changes in U.S. energy policy and use these emissions can only grow.⁴

What may be the impacts, in the long run, of such an untrammelled build-up of dangerous gases? The predictions range from mild to dire. As one urban "Greenhouse" expert puts it:

Several weather models have been developed to estimate climate change. If they are correct, by 2080, the earth could be 3 to 5 degrees C warmer than today, the hottest it has been since dinosaurs died out a million years ago. It would warm as much in 100 years as it did since the last glacial period 15,000 years ago. . . As the gases build up, effectively doubling current carbon dioxide levels, the heat-reflectivity of the atmosphere should rise, making the Earth a considerably more powerful greenhouse.

The models suggest wetter winters, dryer summers, more droughts, and more stagnation events. With an average temperature rise of 5 degrees, temperatures would rise 10 degrees at the poles, but only modestly at the Equator. That could

mean an end to the prevailing Westerly winds and major changes in ocean currents. As the poles warm, much ice should melt. Sea level appears likely to rise 1 to 2 meters by 2080. Conversely, increased evaporation could lower lake levels, with the Great Lakes falling as much as the seas rise.

If the models are right, deserts could move and new deserts spring up, for example, in Iowa and Nebraska. Much of the Siberian and Canadian permafrost could thaw. Dallas could become tropical. And many of the world's largest cities could be threatened with inundation.⁵

This is strong stuff indeed, and by no means all scientists agree. Dr. Patrick Michaels, a professor of environmental sciences at the University of Virginia, cautioned strongly against jumping to rapid conclusions — and policies — in *The Washington Post* of January 8, 1989. He feels the evidence is far too sketchy and contradictory to predict a future of environmental gloom and doom.

Twentieth-century U.S. temperature data, which formed a part of NASA's congressional testimony last year, hide a drastic warm-measurement bias. NOAA scientist Tom Karl, who arguably knows more about regional climate variation than anyone in the world, has calculated that NASA's record over the United States has warmed up near-

4 Ibid, p. 10

5 Ted R. Miller, *Impacts of Global Climate Change on Metropolitan Infrastructure*, Paper for presentation at the North American Regional Science Association Meeting, Toronto, 1988, pp. 1-2

ly a degree during this century mainly because cities tend to grow up around their weather stations, not because of the greenhouse effect.

If the effect of urbanization ("artificial" warming) on the temperature record averages the same over the rest of the world (and there's no reason to believe it doesn't) then there may have been *no* global warming to speak of during the last century. Karl's finding surprised none of us who daily toil with the data, but it should be a major shock to those who are using those figures for policy purposes. . .

. . . What's a policy maker to do? Some are taking advantage of uncertainty and public hysteria — the politics of fear — in order to promote sweeping actions that can result in major social problems far from our door.

. . . at present the problems with the computer models and the temperature histories are simply too great. Instead, appropriate agencies should be channeling increased resources toward both those areas.⁶

A Research Emphasis

Concern about the long-term implications of the Greenhouse Effect has spurred research at the federal

level. Congress has requested two major studies from the Environmental Protection Agency.

One of the studies would focus on "the potential health and environmental effects of climate change including, but not be limited to the potential impacts on agricultural, forests, wetlands, human health, rivers, lakes, estuaries as well as societal impacts." The second study would examine "policy options that if implemented would stabilize current levels of greenhouse gas concentrations."⁷

The first report has recently been completed, while the policy study is still in process.

In addition to these reports, the Federal Government is conducting other activities on global climate change. The Global Climate Protection Act of 1987 calls for a scientific assessment of the Greenhouse Effect which is to be completed by 1989. This work will be sponsored by EPA and other Federal agencies such as NASA, NOAA, and NSF. Also, DOE and the EPA have been requested to report to Congress on policy options for reducing CO₂ emissions in the U.S. . . Finally, the U.S. Government has strongly supported the establishment of an intergovernmental panel on climate change (IPCC) by UNEP and WMO.⁸

6 Patrick J. Michaels, "The Greenhouse Climate of Fear" in *The Washington Post Outlook*, January 8, 1989, p. C3

7 U.S. Environmental Protection Agency, Executive Summary: The Potential Effects of Global Climate Change on the United States, Draft, October 1988, p. 1

8 Ibid, pp. 1-2

Although the first EPA report generated much useful data and conclusions, the tentativeness with which these conclusions were reached — pending more extensive data gathering and analysis — was summed up in its evaluation of air pollution policy implications.

Global climate change will have important implications for long-term air pollution problems in the United States. Current actions to improve air quality over the next 10 to 20 years through State Implementation Plans do not need to be immediately revised, but long-term strategies to reduce ozone and acid rain levels may need to factor in global climate change in the future. Agencies such as EPA may need to undertake a broad policy review to assess the impacts of current air policies on climate change and the impacts of climate change on air policies.⁹

One of the EPA studies deals with global warming's likely impact on urban infrastructure. The Urban Institute is conducting the analysis and concludes that principal effects will be felt in coastal cities.

Case studies suggest that a doubling in CO₂ levels primarily will require urban infrastructure investments to ensure an adequate water supply and to prevent sea level rise from inundating coas-

tal communities. Impacts are likely to vary substantially by region. Cleveland, and presumably other Great Lakes cities, appear likely to benefit from milder weather but not experience substantial costs for infrastructure construction or management. Anticipated one meter rise in sea level probably will require diking and pumping or raising the land surface in many urban coastal areas, including more than half of the 20 largest metropolitan areas. The cost in Greater Miami alone probably will exceed \$600 million. It appears that inland cities primarily need to be concerned about water supply and electric power, and the possibility of increased subsidence problems.¹⁰

Miller's paper goes on to sum up the unclear national policy implications of global warming on urban infrastructure.

The uncertain, yet potentially imminent impact of global climate change already has increased the riskiness of infrastructure investment. Application of design standards and extrapolation from historical data might not still provide reasonable assurance that water and power supply, dam strength and capacity, bridge underclearances, or storm sewerage capacity will be adequate for the 35-, 50-, and 100-year design lives of these facilities.¹¹

9 Ibid, p. 30

10 Ted R. Miller, op. cit., p. 1

11 Ibid, p. 11

While the EPA studies have looked at waterfront cities and at regions such as the southeast and California, thus far none has dealt directly with implications for metropolitan areas in the Middle Atlantic states, specifically Washington and its suburbs.

The Precursor of Legislation — HR 5460

Much research remains before definitive conclusions can be reached, but Congress has already begun to debate the Greenhouse Effect. Several committee hearings were held in 1988 and some eight bills introduced. Although unlikely to be passed in their current form, the proposals do establish directions for ultimate Congressional action. The most sweeping bill, and one which could have the most direct impact on a local community, is HR 5460, titled the "Global Warming Prevention Act of 1988." Introduced by Rep. Claudine Schneider of Rhode Island, the bill is co-sponsored by Montgomery County Congresswoman Constance Morella. A companion bill (S 2867) has been introduced in the Senate.

The House bill sets an objective of a 20 percent reduction in CO₂ levels by 2005. It is targeted primarily, although not exclusively, at consumption of fossil fuels. Representative Schneider said in introducing the legislation:

The bottom line result of this approach is to engender, as much as is possible, a positive sum strategy that cuts greenhouse gas emissions while cutting energy costs at the same time. Indeed, based on the available evidence of what the least-cost energy approach offers we could as well as referred to this bill as the "global competitiveness and U.S. productivity enhancement act." The several dozen policy measures detailed in this legislation should: help consumers eventually save several hundred billion dollars per year on their energy bills; create high efficiency, energy-generating and energy-consuming products and services for export; reduce foreign oil imports and the trade deficit; and reduce a range of other environmental pollutants in addition to greenhouse gases.¹²

Principal features of the legislation that would impact domestic U.S. activity are:

On the automobile: increased mileage standards to reach 45 mpg for cars and 35 mpg for light trucks by 1995; stiff gas-guzzler taxes on inefficient vehicles; and tax rebates up to \$2,000 for purchase of efficient vehicles

Substantial sums for R and D in energy; particularly solar and other renewable resources, fuel cells and hydrogen; ethanol; and for co-generation systems.

12 The Hon. Claudine Schneider, in the *Congressional Record*, Vol. 134, No. 141, October 6, 1988

Funds for state energy conservation programs, and the requirement that states produce energy conservation plans

Efficiency standards for federal buildings, for lighting and windows

Major research on natural gas for mass transit use and on intercooled, steam-injection gas turbines for power generation

Incentives for recycling, for municipal waste and sewage composting; and bans on non-recyclable materials.

Of particular interest is the proposed emphasis on urban forestry. The bill itself states:

...the preservation and expansion of forests are fundamental to slowing down the global "greenhouse effect";

...research by the Federal Government indicates that properly sited tree plantings around urban buildings offer a very low-cost means of significantly reducing electrical generation for air conditioning and provide dual benefits of restricting carbon while reducing emissions from electric generation; and

...there remain enormous opportunities in the United States for increasing the planting of trees in urban, suburban, and rural areas.¹³

The bill calls for the Department of Agriculture to conduct a study on the feasibility of a major national tree-planting program that would include urban and suburban areas. According to one recent study, trees have a significant effect on containing CO₂ emissions and could be a very likely component of any global warming legislation to be enacted at the federal or state levels.

...A tree that provides shade can indirectly cause reductions in CO₂ emissions equivalent to 15 times the amount of CO₂ the tree alone can absorb.

One acre of trees can absorb an estimated four tons of carbon annually, the amount released by burning 1000 gallons of gasoline.¹⁴

Implications for Montgomery County

The Greening of Montgomery County

Advocates for combating greenhouse gases place considerable emphasis on vegetation as a sponge to absorb carbon dioxide. If vegetation were the only factor

13 HR 5460, pp. 142-3

14 Sheila Machado and Rick Pilz, *Reducing the Rate of Global Warming, the State's Role*; Renew America, Washington, D.C., 1988, p. 6

Agency	Acreage
M-NCPPC	26,000
Federal	3,146
WSSC	3,100
State of Maryland	10,939
Private open space under easements or other control	2,318
Municipalities	<u>1,400</u>
Total	46,903

involved, Montgomery County would be among the best-positioned communities in the country to handle its own share of the global warming problem. Indeed, Montgomery County's situation is truly extraordinary,

as a direct result of past planning and parkland acquisition/development policies.

Let's take parks, for example. As of 1988, Montgomery County had 46,903 acres of parkland, about 15 percent of the jurisdiction's land area. Some 26,000 acres, or over half, was under the stewardship of the Park and Planning Commission. The figures break down as shown at left.¹⁵

For the County's 1988 population, the figures work out to be 44 acres/1,000 for MNCPPC parks alone, and an amazing 79 acres/1,000 overall. These compare with recommended minimum standards by the National Parks and Recreation Association for "close to home" parkland of 6.25 to 10.5/1,000¹⁶ and for the Commonwealth of Virginia of 10/1,000 for all parkland.¹⁷

Of course all of these acres are not covered with trees. Many are used for ballfields, tennis courts, and other recreation facilities. Nonetheless, many are untouched stream valleys, reservoir protection areas, and densely wooded regional parks. Tree cover is extensive.

Much of Montgomery's parkland is also not readily accessible to denser neighborhoods, particularly in the

15 M-NCPPC, *Park, Recreation and Open Space Master Plan Comprehensive Amendment* for Montgomery County, 1988

16 Ibid, p. 28

17 The 1984 *Virginia Outdoors Plan* as referenced in The City of Virginia Beach's *Master Facilities Plan for the Department of Public Libraries and the Department of Parks and Recreation*, 1986

down-county area. Interestingly enough, however, the Park and Open Space Plan displays figures (M-NCPPC only) on page 42 by planning area, and none falls below the recommended minimums.

Montgomery County's relative strength may be seen by a couple of comparisons. It is fair to say that Fairfax County is the Washington Region's other prime suburban residential and employment center. According to data from the Fairfax County Office of Comprehensive Planning, only 9.2 percent of that jurisdiction's land is in parks, less than two-thirds that of Montgomery. The overall index on a population basis is 31 acres/1,000, less than half the Montgomery condition.

The City of Virginia Beach (configured like a county with over 200 sq. miles of land area) has been one of the most rapidly growing on the east coast. Its elected Council has undertaken both comprehensive planning and growth management. There, total parkland amounted to 4 acres/1,000 in 1985.

Parkland is one measure of vegetative protection against global warming. Montgomery County is doubly unique because of its agricultural preservation area. The agricultural reserve (25 acre zoning) was enacted in 1980. Combined with the Transferrable Development Rights system (permitting land owners in portions of the Reserve to sell their development rights to developers in designated receiving areas) for which the County has received national recognition, the pro-

gram has established permanent open space protection for roughly thirty percent of the County's land area.

When parks are added to the Rural Density Transfer zone, it appears that over 40 percent of Montgomery County is protected as permanent green space. Again, a comparison with Fairfax County illuminates Montgomery's relative position. In Fairfax County, some 2,386 acres has been placed in Agricultural and Forestal Districts for permanent preservation as farm land or wooded area. When added to parks, it turns out that only 10 percent of Montgomery County's chief "competitor" in this region is protected green space.

These comparisons say a great deal — about Montgomery County's relative ability to maintain a high standard of residential and working environment in the face of global warming, about the strength of the Wedges and Corridors planning concept, and about the County's resolve to acquire land for parks which dates back to 1927 and formation of the Commission.

If further efforts to counter global warming become a priority, then acquisition and development of additional parkland should also be a priority in the County's Capital Improvement Program. The Park and Open Space Plan sets forth CIP acquisition requests (1987-93 and Beyond 1993) which are indeed modest compared with what is already in hand. These

amount to 4,062 acres (about 15 percent of present holdings) over one-half of which would be for stream valleys.

Public parks and large agricultural preserves represent considerable protection, but there is still the private side of the equation to be addressed. Greenhouse research demonstrates that trees planted near buildings and in parking areas both absorb CO₂ and reduce air conditioning requirements. Certainly the older, down-county residential areas have had ample tree cover on residential lots, and some neighborhoods maintain an inventory of street trees which are replaced in the event of loss. Streetscape and tree planting are stressed in CBDs and in site plan review of proposed developments.

Nonetheless, many of the newer subdivisions are being developed on a least-cost basis, removing mature vegetation in favor of building sites. In assessing its response to global warming, the County might do well to consider the recent Commission on the Future recommendation to enact a tree protection ordinance:

Mature trees provide a habitat for birds and wildlife, moderate temperature extremes and provide beauty. Some developers have discovered that their houses are more desirable when surrounded with the mature trees that grew on the

land before construction and have developed ways to preserve those trees. Unfortunately, not all have seen the wisdom in this. And the developers are often required, unnecessarily, to clear trees by county road ordinances. The preservation of trees is important, and we should work to that end.¹⁸

The Fossil Fuel Fall-Out: Automobiles, Energy, and Transit Serviceability

The greening of Montgomery County will go a long way towards maintaining our competitive edge as a fine environment for residence and commerce in the event of federal legislation to contain global warming. It will not do the entire job, however, and many of the same planning policy issues — and options — discussed in the papers on Petroleum Dependency, Automobile Innovations, and Air Quality will come to the fore. All the more so, because the green wedges and protected agricultural periphery fall under increasing pressure for erosion by demands for low density subdivisions, office parks, and highways.

Take the automobile, for example. If HR 5460, or derivative legislation were enacted, the automobile industry has the technology to introduce high-mileage, lower-polluting vehicles within a relatively short time, vehicles that may be even more affordable by 2010 than today. There might be a lag, but the prospects are

18 The Commission on the Future of Montgomery County, *Envisioning Our Future*, June 1988, p. 108

real that vehicles registered within the County will increase from the 543,000 in 1986 to over 800,000 in 2010, if COG's intermediate level household forecast is reached. Combine these with those of commuters from other jurisdictions and a constrained County road budget, and today's level of congestion pales by comparison. The air may be cleaner, and the temperature lower, but the transportation problem remains.

Public transportation, carpools, and vanpools help address global warming, air pollution, and congestion. Numerous measures to enhance our transit system and HOV ridership have been discussed in the companion papers and are incorporated here by reference: light rail lines to Clarksburg and beyond and on the Georgetown Branch; HOV lanes on I-270, Route 29, and the ICC; denser and more frequent connecting Ride-On service; neighborhood jitneys; more extensive work with employers to establish ride-sharing; transit subsidies by government and employers; elimination of free employee parking as a fringe benefit; parking taxes; and the host of allied transportation management measures that were depicted in the *FY 1988 Annual Growth Policy's* supporting document *Alternative Transportation Scenarios and Staging Ceilings*.

Montgomery County's current overall level of 12 percent transit use for work trips is superior to most suburbs, but will be very difficult to maintain if new households and job centers are dispersed at low density. Transit serviceability thus becomes an imperative

to address global warming, air pollution, and congestion. This means planning and zoning policies that:

maintain and build upon the strengths of neighborhoods and planning areas that are transit serviceable today

establish guidelines which encourage planning areas where new development will occur to evolve at higher than currently-planned densities and become transit serviceable.

In the companion papers, we cite several promising approaches from concentration of growth near Metrorail and new light rail stations, redevelopment of underutilized land accessible to transit, mixed-use residential and commercial complexes, improved subdivision design that permits High Occupancy Vehicle access. We also indicate that considerable spade work needs to be done, ideally within the comprehensive plan review process, to develop models which establish "transit serviceable" densities and land use patterns for residential and commercial projects.

At the same time, we have noted the strong pressure to forestall compact development, from market forces pushing low-density growth to neighborhood opposition against infill. County planning policy is not yet consistent in its approach: Draft plans for Silver Spring call for intensification of growth at the core, which has excellent transit access. The draft *Bethesda-Chevy Chase Master Plan*, the planning area that is

third highest in transit use, calls for less new housing to the year 2010 than the draft FY 90 AGP would permit. Clearly issues exist, and priorities conflict — all matters to be addressed county-wide through comprehensive plan review.

Three additional planning considerations discussed in the companion papers are relevant to containing the Greenhouse Effect.

Home-based work, including telecommuting, holds some promise for keeping Montgomery County residents and commuters from other jurisdictions off the roads in the 21st century. The HBW paper suggests that as many as 40,000 new jobs within the County could be held by home-based or telecommuting workers in 2010, generating an average daily savings of over 19,000 driver work-trips. The extent of real savings would depend on whether the trip ends were concentrated or dispersed.

The air quality paper reiterated a recommendation of the County's draft 1988 Comprehensive Energy Plan that cogeneration facilities (electric power production and area heating/airconditioning) be considered for large scale mixed-use developments. Co-generation has proven a strong energy saver and a factor in both air pollution control and reduction of greenhouse gases. Pending federal legislation on both air quality and global warming afford incentives for co-generation. Georgetown University is the site of a national demonstration project, and at least one such facility

(at GEICO in Friendship Heights) currently operates in the County.

The air quality paper also suggested consideration of "pollution offsets" in the County's land use control procedures. The idea resembles that used by the Corps of Engineers and state government in permitting development on wetlands. Development on wetlands is allowed under certain circumstances, but applicants must replace the proposed amount of drained land with new wetlands created elsewhere on the property.

Major development — industrial parks, shopping centers, mixed-use projects, large scale subdivisions — engenders greenhouse gases, as well as air pollution and traffic. What if developers were required to conduct pollution-reduction measures that matched (or exceeded) the scale of any likely additions?

The measures could vary. For example: installation of co-generation plants in large mixed-use projects. Other measures might involve high-efficiency furnaces; electric lighting, windows, and other building materials which meet the standards recommended under HR-5460; or jitney services between new residential developments or office complexes and the nearest Metrorail station.

The offset concept could be introduced in the zoning ordinance and/or as part of annual growth policy review. In the same way that the AGP permits developers to stipulate to traffic mitigation programs

(removing as many trips as they generate beyond the ceiling) Montgomery County could consider air pollution and greenhouse gas removal incentives as a component in development approvals. Zoning power has its origins and roots in public health objectives, which may well soon include containing the Greenhouse Effect.

Concluding Note

Until more definitive research is done on the Washington area itself, it will be difficult to know whether climate change will require special measures (and capital costs) to protect the County's water supply and transportation infrastructure.

If, however, Congress does enact major legislation to contain global warming, many communities across the country will need to struggle with conformance. Montgomery County has an extraordinary advantage, both nationally and within the Washington Metropolitan area. As a legacy of more than six decades of effort, it has an array of parks, open space, and permanent farm land and forests that both shape the County's development pattern and provide significant absorption/containment of greenhouse gases.

At the same time, increasing auto ownership and increasing pressure for low-density development threaten to erode both the scale and the performance of the County's green preserve. Redoubled efforts to encourage public transit and other alternative

transportation, to establish transit serviceability in new growth areas as well as old and to foster energy efficiency, will be as important in addressing the greenhouse effect as other major environmental issues that impact on planning policy to the year 2010.

Chapter 3

Petroleum Dependency and Montgomery County

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PETROLEUM DEPENDENCY AND MONTGOMERY COUNTY

Primary Sources

Christopher Flavin, Denis Hayes, and Jim MacKenzie, *The Oil Rollercoaster: A Call to Action*; Fund for Renewable Energy and the Environment, Washington, D.C., 1987

John Pucher, "Urban Travel Behavior as the Outcome of Public Policy: The Example of Modal-Split in Western Europe and North America," *Journal of the American Planning Association*, Autumn 1988

Christopher Flavin, *World Oil: Coping with the Dangers of Success*, Worldwatch Paper 66, Worldwatch Institute, Washington D.C., July 1985

Let the debate begin! May a hundred flowers bloom.¹

What to do about America's increasing dependence on foreign oil is shaping up as a major public controversy for the 1990s. Some automakers, with their introduction of bigger, less fuel-efficient cars and trucks would have us believe that the oil glut is here to stay. Some experts such as Ebinger and Flavin contend that crisis can strike at any time and we had better be prepared with higher energy efficiency and alterna-

tive fuels. The Federal Government, lacking consistent policy, appears to be playing it both ways: moderating fuel efficiency standards and enacting legislation providing incentives for ethanol/methanol powered vehicles. The public is confused by mixed signals.

Let us begin by trying to put the present situation in some perspective. Before the Arab oil crisis of the 1970s, America was the most profligate of nations in respect to petroleum consumption. Faced with the challenge, the country responded by instituting a wide range of conservation measures — from new building insulation standards to dramatic improvements in the fuel efficiency performance of the internal combustion engine. While the conservation discipline of the public may have been fleeting in the process, the efficiency measures had an effect. Between 1973 and 1985, the energy efficiency of the United States improved by 23 percent, more than Canada, the U.K. and West Germany. It was exceeded only by Japan's 31 percent.²

... such improvements have come largely unnoticed, the result of subtle shifts in the economy

1 Charles K. Ebinger in the Introduction to Flavin, et al, *The Oil Rollercoaster: A Call to Action*, Fund for Renewal Energy and the Environment, Washington, D.C., 1987

2 Christopher Flavin and Alan B. Durning, *Building on Success: The Age of Energy Efficiency*, Worldwatch Paper 82, Worldwatch Institute, Washington, D.C., 1988, p. 8

and technological advances, rather than lower thermostat settings or redesigned transportation systems. Higher energy prices have spurred engineers, managers, and consumers to make operational changes and apply a backlog of new technologies.³

The most dramatic of changes occurred with motor vehicle fuels as the accompanying chart attests.

Until the early eighties, efficiency improved sharply year after year. This was particularly true in the United States, where the industry was subject to the triple pressure of rising fuel costs, intense Japanese competition, and mandatory U.S. government standards (effective in 1978). New passenger cars in the United States today are almost twice as efficient as the gas-guzzling behemoths of the early seventies; as a result, the average fleet fuel economy rose from 13 miles per gallon (mpg) in 1973 to 18 mpg in 1986 . . . Had fuel efficiency stayed at the dismal level of the early seventies, U.S. gasoline consumption would have grown by fully one-third and pressure on world oil markets would be much greater today. Instead consumption remains approximately the same as 15 years ago.⁴

In the meantime, however, as the result of the oil glut, gasoline prices have fallen and in real terms are less today than in the 1970s. Renner states that gas and oil accounted for only 15 percent of total vehicle operating costs per mile in 1986, versus 26 percent in 1975.⁵

While the United States has clearly moved in the direction of greater energy efficiency, it has just as clearly not moved as decisively as other western nations to control automobile use, the primary consumer of petroleum.

Attached are two tables from a study by John Pucher which appeared in a recent edition of the APA Journal. The first displays the extent of taxes on auto ownership and use levied by the United States, Canada and other industrial countries, and changes over time. The second displays modal split for all urban passenger trips taken at different times during the late 1970s and the 1980s. (Note, while the U.S. figure is given as of 1978, it appears comparable with current distribution as reported in studies by the ENO foundation and others.)

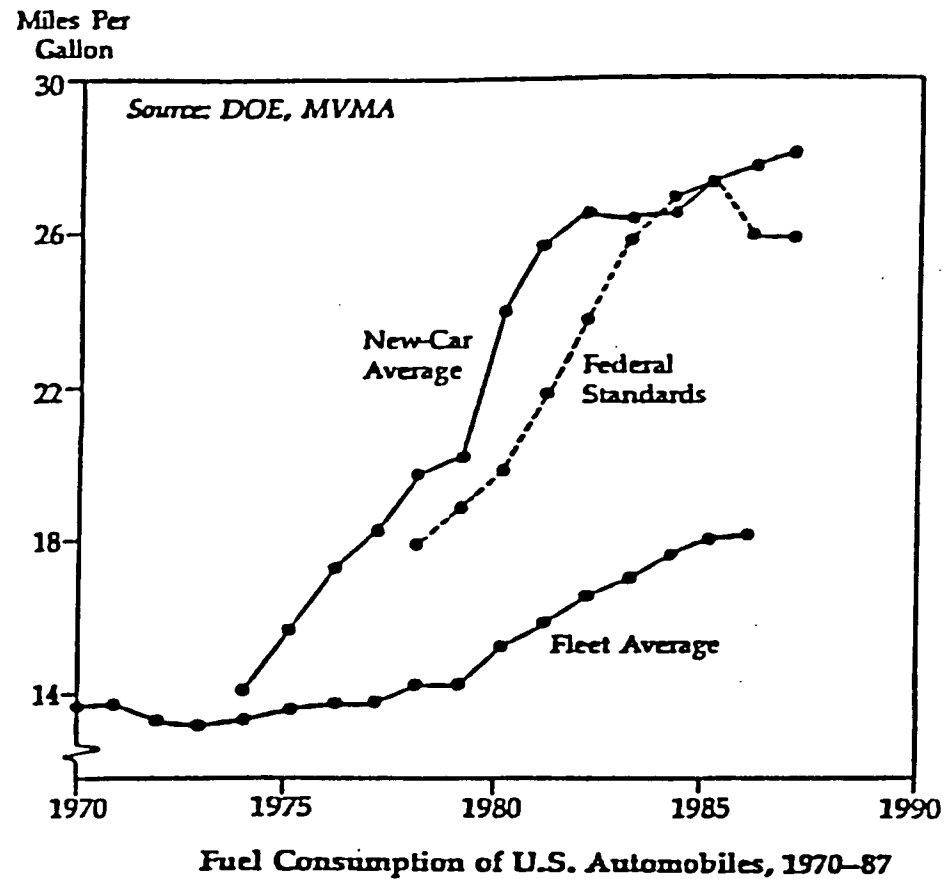
The taxation table shows that the U.S. had the lowest levels of gasoline and related motor vehicle taxes in both 1978 and 1987. Most of the other industrial countries were taxing at five to eight times the U.S. rates.

While there cannot be a one-to-one correlation between more fuel-efficient public transit use and taxation, the relationships are quite clear. All the countries except the Netherlands (where bicycle use substitutes

3 Ibid, pp. 9-10

4 Michael Renner, *Rethinking the Role of the Automobile*, Worldwatch Paper 84, Worldwatch Institute, Washington, D.C., 1988, p. 26

5 Ibid, p. 34



Source: Michael Renner, Rethinking the Role of the Automobile,
Worldwatch Paper 84, Worldwatch Institute, Washington,
D.C., p. 27

Taxes on auto ownership and use

Country	Avg. gasoline price/fare		Taxes on gasoline as percent of pre-tax price		Sales taxes as percent of pre-tax price for new, medium-sized car	Average annual taxation on car of 1500cc**
	(1978)*	(1987)*	(1978)	(1987)	(1982)	(1982)
United States	0.18	0.25	23	45	5	119
Canada	0.19	0.37	41	56	n.a.	n.a.
West Germany	0.46	0.61	138	138	14	566
Switzerland	0.51	0.68	170	170	8	587
France	0.56	0.81	170	317	33	730
Sweden	0.41	0.66	108	133	41	450
Netherlands	0.50	0.80	156	245	47	825
Belgium	0.50	0.69	163	178	25	606
Italy	0.59	0.99	245	285	22	n.a.
Austria	0.48	0.75	117	150	52	525
Great Britain	0.32	0.63	100	178	25	652
Denmark	0.50	0.99	178	355	186	758

* In current U.S. dollars.

** In 1982 U.S. dollars.

Sources: International Road Federation 1983: 162-63; Eriksen 1983: 15-17; Jeschke and Kunert 1985; Organisation for Economic Co-operation and Development 1987: 284-89, 305; German Ministry of Transport 1985.

Note: Effective tax rates are shown here both for gasoline and for car purchases. Such rates express tax payments as a percentage of pre-tax price as opposed to purchase price including tax.

Modal-split in urban passenger transport (as percent of total trips)

		MODE					
Country		Auto	Public transport	Bicycle	Walking	Motorcycle + moped	Others
United States	(1978)	82.3	3.4	0.7	10.7	0.5	2.4
Canada	(1980)	74.0	15.0	← 11.0 →			
West Germany	(1978)	47.6	11.4	9.6	30.3	0.9	1.1
Switzerland	(1980)	38.2	19.8	9.8	29.0	1.3	1.9
France	(1978)	47.0	11.0	5.0	30.0	6.0	1.0
Sweden	(1978)	36.0	11.0	10.0	39.0	2.0	2.0
Netherlands	(1984)	45.2	4.8	29.4	18.4	1.3	1.0
Italy	(1981)	30.6	26.0	← 43.4 →			
Austria	(1983)	38.5	12.8	8.5	31.2	3.7	5.3
Great Britain	(1978)	45.0	19.0	4.0	29.0	2.0	1.0
Denmark	(1981)	42.0	14.0	20.0	21.0	---	3.0

Sources: Pucher, Hendrickson, and Macnel 1981: 45; German Ministry of Transport 1984: 44; Webster et al 1986: 46-86; Haskoning Koninkrijk Ingenieur-architectuurbureau 1985: 60; Austrian Ministry of Transport 1985: 818; Italian Ministry of Transport 1985: 11; Central Bureau of Statistics of the Netherlands 1986; Swedish Ministry of Transport 1978; Statistics Canada 1982; Federal Department of Statistics for Switzerland 1985: 53.

Source: John Pucher, "Urban Travel Behavior as the Outcome of Public Policy: The Example of Modal-Split in Western Europe and North America," *Journal of the American Planning Association*, Autumn 1988, pp. 510-513.

for both autos and transit) have levels of transit ridership three to eight times that of the United States.

Pucher comments on his findings.

Americans' greater use of the automobile is not primarily due to greater affluence. In fact, seven of the ten European countries in this study had higher per-capita incomes than the United States in 1980, some of them much higher — for example Switzerland, and West Germany.⁶

Pucher attributes the differences partially to existing low population densities in the U.S., but primarily to differences in public policy towards automobile support, land use, density and transit.

Flavin and his colleagues see the public policy issue in what they contend has been the Reagan administration's dismantling of U.S. efforts to reduce petroleum dependency.

Since 1981 the Administration has:

Abandoned support of gas mileage standards for automobiles;

Opposed efficiency standards for furnaces, water heaters, refrigerators, and other household appliances;

Rolled back programs aimed at increased efficiency for heating and cooling of old and new buildings;

Abolished incentives for renewable energy development and slashed budgets for the most promising renewable energy research; and

Gutted the most successful conservation and renewable energy programs in each of the federal departments, and undermined state programs as well.

This foolhardy program demolished much of the progress of the 1970s. Whereas most of the industrial world learned a lesson in the first major plunge of the oil rollercoaster 13 years ago, the U.S. Government allowed itself to be lulled into complacency.⁷

If a petroleum crisis were, indeed, to occur, the extraordinary vulnerability of the United States — despite past conservation efforts — may be seen in the following passage from Renner's analysis and its accompanying table.

...on average, people in the highly car-oriented American cities use twice as much gasoline per capita as in Australian cities, four times as much as in European cities, and ten times as much as in Asian cities. Even if adjusted for the higher personal incomes, lower gasoline prices, and less efficient vehicles prevalent in the United States, gasoline consumption in the other cities would be considerably lower. U.S. cars travel some 1,250 billion miles annually —

6 John Pucher, "Urban Travel Behavior as the Outcome of Public Policy," *Journal of the American Planning Association*, August 1988, p. 510

7 Op. cit., pp. 2-3

almost the same distance as all other cars worldwide taken together.⁸

Finite Reserves and Challenges to National Security

Oil reserves are apparently finite and, accelerated crisis or no, the world will run out of petroleum as a source of motive power within a century. Flavin contends that just about all the oil that may exist in the world has been identified.

A range of 1,600 to 2,400 billion barrels encompasses all but the most extreme oil resource estimates of the mid-eighties. Of this total 554 billion barrels have already been consumed; 700 additional billion barrels of proven reserves have been discovered. This leaves a range of between 350 and 1,150 billion barrels of oil remaining to be discovered. About 21 billion barrels are being extracted each year. At the 1985 rate of consumption, the ultimate depletion of world oil resources is between 50 and 88 years away. Little of the world's petroleum is likely to remain by the bicentennial of the world's first oil well in the year 2059.⁹

Thus, if no crisis occurs, we have a generation or more to perfect research on such alternative vehicle fuels as hydrogen, battery-powered electricity, alcohol derivatives, etc. Oil dependency will end, but there will be time to convert. Of course, the earlier conservation efforts are undertaken and the more successful conservation these efforts are, the longer the transition may be.

8 Op. cit., p. 17

9 Flavin, *World Oil, Coping with the Dangers of Success*, op. cit., p. 25

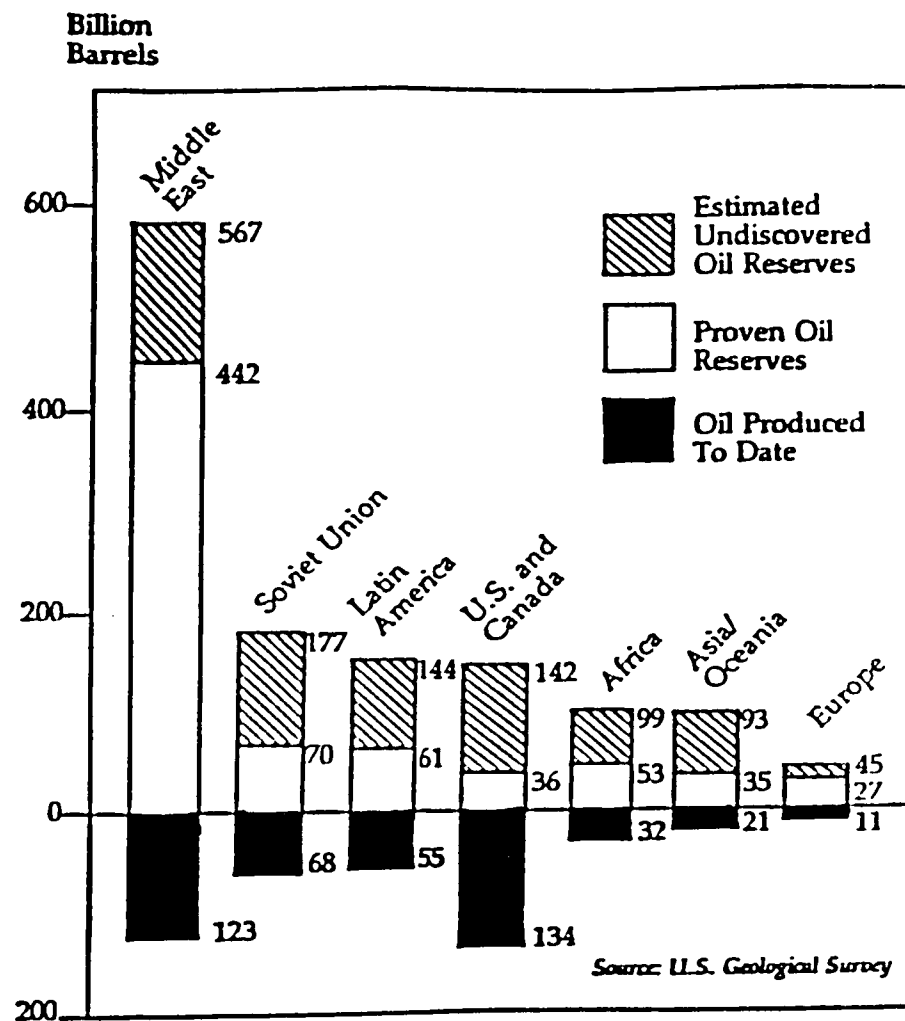
10 Flavin, *ibid.*, p. 34

The issue does not seem to be existence of oil resources in the next generation or even price. (Some commentators suggest that OPEC will pump out fast and cheaply because its members see an end in sight and want to derive as much revenue as possible.) The issue is where the petroleum resources are located. The accompanying chart from Flavin tells the story.

Some 56 percent of proven reserves and an estimated 23 percent of undiscovered reserves are in the Middle East. It is this fact of geography which makes the U.S., as the world's largest oil consumer, vulnerable.

Non-Middle Eastern oil production is approaching its peak. by 1990 at the latest, declining oil production in the United States, the Soviet Union, and Great Britain will greatly outweigh increases in such countries as Brazil, Columbia, and Mexico . . . The lower the current Middle Eastern share of the market, the greater its share at the end of the century when many countries will be running out of oil. The danger is that the Persian Gulf may move back into the driver's seat at a time when world oil resources are more limited than at any time in recent history.¹⁰

Oil reserves in the U.S. are less than five percent of the world total, although the U.S. is still the world's second largest producer as well as the largest consumer. Oil imports already account for one third of



World Oil Reserves and Cumulative
Production by Region, 1984

Source: Christopher Flavin, World Oil: Coping with the Dangers of Success, Worldwatch Paper 66, Worldwatch Institute, Washington, D.C., July 1985, p. 28

World Automobile Travel, Selected Countries, Circa 1985

Country	Distance Traveled	Distance per Car
	(million vehicle miles)	(miles)
United States	1,253,248	9,801
West Germany	194,621	8,446
Japan	164,625	5,913
France	162,702	7,763
United Kingdom	141,588	8,073
Italy	132,610	6,148
Australia ¹	59,684	9,501
Spain	34,962	5,651
Sweden	32,851	7,452
Argentina	19,350	7,063
Poland	12,540	3,416
South Korea	3,119	5,603
Indonesia ¹	2,360	3,726
Cameroon	570	7,867 ²
Rwanda	176	9,315

¹1982.

²1983.

Source: International Road Federation, *World Road Statistics 1981-1985* (Washington, D.C.: 1986).

Source: Michael Renner, Rethinking the Role of the Automobile, Worldwatch Paper 84, Worldwatch Institute, Washington, D.C., p. 17

the U.S. trade deficit. While imports represented 27 percent of U.S. supply in 1985, the Oil Rollercoaster study contains estimates that this might rise to 75 percent by the year 2000.

Experts worry about the current oil glut and about the apparent lack of urgency to move forward with conservation and alternative fuels because they perceive a real danger to national security.

As a result national security is now threatened, the possibility of war over oil looms large, anxiety about the shape of our energy future increases, and the short-term attraction of low oil prices feeds our energy self-indulgence and clouds public debate. Unless strenuous efforts are made to cope with declining domestic oil production and increasing consumption, America will find itself exposed to unprecedented vulnerability.¹¹

Implications for Montgomery County

It is useful to give some dimension to the scale of Montgomery County's petroleum dependency. According to the draft 1988 Comprehensive Energy Plan, public and private sectors combined spent about \$1.2 billion on energy in 1986. Vehicle fuel accounted for 43 percent of the total expenditure, and 46.5 percent of total energy consumption.

11 Flavin, et al, op. cit., p. 3

If no petroleum crisis occurs between now and 2010, or if substitution of alternative energy sources for petroleum is significant, planning for Montgomery County will have to address the escalating levels of motor vehicle use which these figures represent. A companion paper on automotive innovations has been prepared as part of this "external factor" review. Its conclusions and their implications for planning policy will only be referred to here.

Substitution of Energy-efficient Vehicles

The primary focus of this paper is on the County's ability to cope if petroleum shortages do ensue. In examining the situation, it is important at the outset to make a general comment on national preparedness. If a crisis does occur, the automobile industry is far better able to introduce a fuel-efficient vehicle fleet today than it was during the Arab oil embargo of the 1970s, or would have been had that shortage had been prolonged. While not generally in service or on the production line, fuel efficiency technology is now so advanced that substitution of a whole new vehicle fleet can be accomplished far more rapidly than a decade ago.

Below is a table taken from Flavin and Durning which portrays an array of vehicles whose fuel consumption ranges from 42 to 124 mpg, many times greater than the average cars now on the road. Although only one

**Fuel Efficiency of Selected Four-Passenger Automobiles,
1987**

Model	Fuel	Composite Fuel Efficiency (miles per gallon)
<i>In Production</i>		
Peugeot 205	gasoline	42
Ford Escort	diesel	53
Honda City	gasoline	53 ¹
Suzuki Sprint	gasoline	57
<i>Prototypes</i>		
Volvo LCP 2000	diesel	71
Peugeot ECO 2000	gasoline	73
Volkswagen E80	diesel	85
Toyota AXV	diesel	98
Renault VESTA	gasoline	124

¹City driving; composite urban-highway figure would be higher.

Source: Deborah Bleviss, *The New Oil Crisis and Fuel Economy Technologies: Preparing the Light Transportation Industry for the 1990's* (New York: Quorum Press, in press).
Renault VESTA from Dan McCosh, "Automotive Newsfront," *Popular Science*,
December 1987.

Source: Christopher Flavin and Alan B. Durning, Building on
Success in the Age of Energy Efficiency, Worldwatch
Paper 82, Worldwatch Institute, Washington, D.C.,
1988, p. 27

American model is included (Ford), General Motors has also introduced a new "GEO" line with claims of achieving up to 50 mpg. Most of the experts believe that overall standards of 50-60 mpg could be in place by the 1990s.

There can be little argument about the technical potential for extraordinarily efficient automobiles, but automakers know that fuel economy is a relatively low priority for most consumers at today's lower fuel prices. Many have cut back their efforts to improve fuel efficiency while focusing on fancy electronics and other amenities that they believe will please customers. However, fuel efficiency need not come at the expense of other important features. High-efficiency models can be safe, reliable, affordable, and even 'sporty' as the Honda CRX and the Volvo LCP demonstrate.¹²

More efficient models could be introduced as a response to reduced petroleum supply, increased cost by the suppliers, or action by the federal and state governments to tax gasoline at levels comparable with European industrial nations. Higher gasoline taxes could well be introduced as a revenue-raising measure (often discussed in the press as a prime prospect for Federal deficit reduction), as a policy measure to discourage fuel consumption, or both — thus engendering a mini fuel crisis for fiscal reasons.

In such an event, while short term disruptions might occur, Montgomery County's economy would not suffer serious long term damage within the 2010 planning framework. Fuel issues alone (apart from their linkage to air quality and traffic congestion concerns) would not have an impact on land use and transportation patterns.

An Auto-oriented System

Let us assume, however, that a sudden curtailment of petroleum does occur. How effectively will Montgomery County be in a position to adjust?

First of all, it is clear that Montgomery County is an auto-oriented society and becoming more so. According to studies for the County's Energy Plan, passenger vehicles registered to Montgomery County rose from 1.68 per household in 1976 to 1.99 in 1986. The number of registered trucks rose by 70 percent during that decade to 47,080, to some degree as a function of increasing job development in the County. All told, the 1986 ratio of fuel powered vehicles per household stood at 2.2, for a total of over 543,000. Montgomery County also has a large number of multi-vehicle households — more than the Metropolitan Area average. According to a recent COG report, some 16 percent of area households had three or more cars.¹³

12 Flavin and Durning, op. cit., pp. 28-9

13 Metropolitan Washington Council of Governments, *Cars Overtake People*, March 1988

In Montgomery County, the figure was 19 percent.¹⁴ Thus, the County is indeed vulnerable to a petroleum shortage.

Relative Strengths

At the same time, however, the County today is less vulnerable than many urbanized and urbanizing jurisdictions because of its transit systems in place and (at least in certain portions of the County) its attendant land use and density patterns.

The significance of compact, mixed-use land patterns and public transit availability is extremely important in coping with a petroleum shortage. As Flavin and Durning have put it:

Urban design decisions made today will affect the world's energy needs for decades. Vast amounts of energy can be saved by channeling urban growth so that jobs, stores, and residences are concentrated in city cores and along mass transit corridors. Rapidly growing cities...are particularly well placed to capitalize on these savings. Of course the world's cities can not be restructured overnight, and there are scores of considerations beyond oil requirements that must shape urban development. But designs that optimize convenience and a sense of community also tend to be energy efficient. Reduced commuting distances save citizens precious time, as does offering an array

of stores, services, theaters, and parks within each community.

Public transportation can offer additional savings. Trains, buses, van pools, and public cars require a quarter as much fuel to move each passenger a kilometer as private cars do — if they are well used.¹⁵

In respect to transit accessibility and use, Montgomery County is far better off than many other jurisdictions. A high-speed metrorail system is in place and will be extended. Metrorail ridership in Montgomery County rose from 11.1 million in 1980 to 22.4 million in 1987. Ride-on passengers increased as well, from 6.4 to 10.0 million, while Metrobus ridership was about a flat 11 million. According to the FY 1990 draft AGP public transit use for the work trip was 12 percent in 1987, just about double the national average.

In the more compact residential areas, where densities are higher and jobs more directly accessible to residential areas, public transit use is well above average. In the two business districts (Bethesda and Silver Spring) resident public transit use is well over 30 percent for work trips. The levels in down-county planning areas are also high: Bethesda-Chevy Chase, 15.2 percent; Silver Spring-Takoma Park, 27.5 percent; North Bethesda, 16.2 percent. These areas will, doubtless, be significantly less inconvenienced in a petroleum shortage than more low-density up county areas (e.g.,

14 Montgomery County Executive, *Draft Annual Growth Policy Report FY 1990*, December 1988

15 Flavin and Durning, *op. cit.*, pp. 23-24

Cloverly, 2.8 percent; Damascus, 3.8 percent; Potomac, 7.8 percent) where residence and the automobile dominate.

Potential for Greater Transit Access

Down-county density patterns and the relatively close juxtaposition of jobs to housing that they afford suggest even more substantial public transportation improvements could be made in these areas if a petroleum shortage limited vehicle use. The following table has been derived from the 1984 Montgomery County Census Update. It shows the proportion of resident job-holders in each traffic analysis area whose jobs are also within that area. For example, about 42,000 residents of Bethesda-Chevy Chase are employed. Almost 30 percent of them work in Bethesda-Chevy Chase.

This information is quite significant. It demonstrates that those portions of the county where the greatest concentration of jobs exists today, employ substantial numbers of people who live nearby. Most of these workers probably drive to work now. If a petroleum shortage were to ensue, stepped-up efforts at short-haul ridesharing, increased Ride-On service, and other forms of paratransit (such as neighborhood jitneys as proposed by the Commission on the Future) hold considerable promise as means of alternative transportation and reducing adverse economic impact.

Distribution of Internal Commuters

Traffic Analysis Area	Total Jobs Held	% of Employed Residents Working in Traffic Analysis Area
Bethesda-Chevy Chase*	41,690	29.8
Silver Spring-Takoma Park*	17,330	18.9
Kemp Mill-Aspen Hill-Wheaton-Kensington	77,990	12.5
Olney	9,190	15.5
Rockville* (Rockville and North Bethesda)	23,320	37.9
North Bethesda* (North Bethesda and Rockville)	18,190	28.9
Gaithersburg*	37,480	33.5
Germantown	10,540	9.0
Potomac	17,680	10.9
Travilah-Darnestown	5,020	4.0
Cloverly	9,760	19.5

Source: Rivkin Associates as derived from M-NCPPC figures on the 1984 Census Update.

*Areas which are also locations of principal employment concentrations in Montgomery County.

In preparing this review, we have been asked to look at the High Occupancy Vehicle concept. If HOVs are to encompass buses, car and vanpools, the approach is clearly relevant. Efforts to enhance current HOV ridership levels within the County for neighborhoods and employment centers that lack direct Metrorail access

or would not be serviced by light-rail systems now under study (the extension from Shady Grove to Clarksburg, the Georgetown Branch between Bethesda and Silver Spring) could be intensified in the interest of protecting the County's economy. The County already has much of the support "infrastructure" in place, from Ride-On to ridesharing programs to vanpool subsidies and a pilot effort at subscription-service jitneys.

Through these, and developer-based ridesharing programs, car and vanpooling has increased. There are 890 car and vanpools operating in the county, with about 4,000 active applicants pending assignment in the match list program.¹⁶

Thus, the current land use and employment pattern may lend itself to more extensive HOV service if options for driving alone are reduced as a result of petroleum shortage — or if higher vehicle operating costs result from price and taxation increases.¹⁷

The figures on the Census Update table do not, of course, address the extent of commuting to County jobs by residents of adjacent traffic analysis areas. Nor do they depict the extent of commuting to the County

by employees who do not live in the County. These would certainly increase if the jobs/housing gap grows. Closely orchestrated HOV service could aid these groups, especially if formulated with other jurisdictions as part of a regional program to maintain the Washington area economy in the face of petroleum shortages.

Land Use Considerations

Efforts to increase transit-serviceability of the County's residential areas and employment concentrations would also help. These could include encouragement to generally higher residential and employment densities, mixed-use areas, greater concentration of activities at Metro stations and other transportation nodes, and improved subdivision design to permit better transit access. These matters are all identified in the Automobile Innovation paper cited above, but they have relevance to coping with energy shortages as well.

They are also relevant to supporting adequate service standards for County residents, apart from home-to-work commuting. Long drives to shopping centers,

16 W.S. Fleming & Associates, *Draft Montgomery County 1988 Comprehensive Energy Plan*, p. 38

17 One cannot be quite so sanguine about the significance of dedicated High-Occupancy Vehicle lanes on County expressways and limited access arterials. The purposes of HOV lanes are to reduce traffic congestion, to speed passenger movement, and to engender fuel savings under conditions of intense automobile use. The State of Maryland is currently considering HOV lanes on I-270 and on Route 29, and there is some interest for the Inter-County Connector. With a long-term petroleum shortage, however, and commensurate high prices for fuels it is inevitable that personal automobile use will drop — as occurred for brief periods in the 1970s. Under these circumstances, it is quite likely that the HOV lane will become superfluous for all its objectives.

recreation opportunities, schools and other institutions may not be supportable during a petroleum shortage. To the extent that more compact, multi-use land patterns can be achieved (through retrofitting existing development and establishing standards for zoning and subdivision of new areas) and activity areas become accessible by foot/transit/bicycle, the negative impacts of a petroleum shortage can be mitigated. The planning and policy issues such a direction raises are also discussed in the paper on automobile use.

Compact mixed-use areas at sufficiently large scale also afford an opportunity for significant energy savings through installation of co-generation power plants and district heating. This initiative was called for by the Draft 1988 Comprehensive Energy Plan and merits attention as a conservation measure. Georgetown University is conducting an important demonstration project in co-generation, and at least one such plant (at GEICO) is operating within the County.

Yet another approach would be to increase the County's roster of resident telecommuters — workers who perform some or all of their tasks for area businesses and government at home, along with professionals, consultants, and others whose work is based at home. The possible reduction in work trips associated with this prospect is also relevant in a petroleum shortage situation. It, too, is discussed in a

companion paper on telecommuting and home-based jobs.

Maintaining What We Have: The Policy Challenge

In the final analysis, perhaps the most important planning policy which the County could consider as a hedge against paralysis would be to maintain the relative strength of transit accessibility which the County now enjoys. It will not be an easy task. COG's intermediate level projection for Montgomery County households in 2010 is 371,000, a 52 percent increase over 1986. This is regardless of any policy efforts to alter jobs/housing balance.

Considerable market pressures exist to spread these households, and future employment centers, at low densities in undeveloped sections of the County. Considerable pressure also exists from established citizen groups opposing certain forms of infill development in areas with good transit service today. How the County addresses these issues in the face of population and economic growth will be an important factor in determining how well-positioned we will be to deal with a potential energy crisis.

The County's effort to grapple with these issues is just beginning, and no consistent policy has yet emerged. In the draft *Silver Spring Sector Plan*, for example, alternative scenarios call for a range of 1,200-3,750 dwelling units beyond pending and approved projects and between 400,000-1,100,000 sq. ft. of additional commer-

cial space, development geared to capitalize on and reinforce the transit serviceability of the CBD.

But in the draft *Bethesda-Chevy Chase Sector Plan*, new housing by 2010 over the entire planning area including the CBD is proposed at only 1,000 units more than in the 1988 pipeline, well below the proposed 1990 AGP ceiling. This is in the planning area with the third highest level of transit usage. It is a policy which, if implemented, suggests decanting of potential population growth to less-dense areas which lack transit infrastructure. The recently revised *German-town Master Plan*, moreover, calls for significant reduction in potential density. Germantown, with 6.0 percentwork trip transit riders, is at the low end of transit usage today.

Concluding Note

Clearly, many factors must be considered in establishing long-term policy for individual planning areas, and for the County as a whole. Vulnerability to future petroleum shortages can only be one of these and must compete for attention with other priorities. If this issue does, however, attain high priority in the course of comprehensive plan review, it will be crucial to consider ways of protecting the relatively good transit accessibility patterns which the County currently enjoys.

Chapter 4

Private Vehicle Transportation Innovations and Montgomery County

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PRIVATE VEHICLE TRANSPORTATION INNOVATIONS AND MONTGOMERY COUNTY

Primary Sources

Michael Renner, *Rethinking the Role of the Automobile*; Worldwatch Paper 84, Worldwatch Institute, Washington, D.C., June 1988

Staff of the Kiplinger Washington Letter, *The New American Boom, Exciting Changes in American Life and Business between Now and the Year 2000*, Kiplinger, Washington, D.C., 1986

Introduction

Since the first energy crisis of the 1970s, automotive technology has been the focus of considerable research and development: in fuel efficiency and substitution, in materials and propulsion, and in vehicle types. The bottom line of expert analysis is that costs of purchasing and maintaining a vehicle for personal transportation will probably decline in relation to incomes and that, regardless of any breakthroughs in energy saving, automobiles will continue to proliferate faster than people. The prospects for even more extensive vehicle use in the 21st century than today has profound implications for Montgomery County's land use and transportation patterns.

Kiplinger forecasts the prospects:

By 2000, autos will be so electronically wise, so excruciatingly attentive and protective, that you'll feel either pampered or persecuted. But you won't be bored.

Would you feel comfortable in a car that, when you open the door and sit down, wraps you in a seat belt, adjusts itself to your contours — lowering or raising the seat, tilting the back, moving the steering column — and refuses to budge, or even to start its engine until you pronounce the magic word "Shazam!"? A car that will navigate your trip by satellite and computerized maps? A car in which voice commands will replace button pushing. . . .

You probably won't complain about getting about 50 miles per gallon in city traffic. Such a car will not be cheap, of course, but then cars aren't cheap today. Still the year 2000 car may actually be somewhat less expensive than today's in relation to rising incomes, inflation and quality improvements. . . .

A typical family of four might have three cars: A tiny electric/gasoline hybrid for errands, a two-seater for the teenagers and a six-passenger sedan for family trips and the like. Outdooing families might also have a van/wagon utility vehicle as well.¹

1 Staff of the Kiplinger Washington Letter, *The New American Boom, Exciting Changes in American Life and Business Between Now and the Year 2000*, Kiplinger, Washington, 1986

Fuel Economy and Efficiency

America's most effective and sustained response to the energy crisis of the 1970s has been conservation through enhanced fuel efficiency of the internal combustion engine.

New passenger cars in the United States today are almost twice as efficient as the gas-guzzling behemoths of the early seventies; as a result, the average fleet fuel economy rose from 13 miles per gallon (MPG) in 1973 to 18 MPG in 1986. Had fuel efficiency stayed at the dismal level of the early seventies, U.S. Gasoline consumption would have grown by fully one-third and pressure on world oil markets would be much greater today. Instead, consumption remains approximately the same as 15 years ago.²

Technology exists to raise the efficiency level of conventional fuels still further. Renner's analysis indicates that the average weight of an American car, already down one-third over the past decade, can be further reduced through the use of plastics and new materials such as high-strength low-alloy steel, with no loss in safety. A 10 percent weight reduction can yield a 6 percent fuel economy gain. Weight reduction permits the use of smaller engines, and engine refinements can produce still further economies. (Kiplinger believes that these innovations will permit the car of the 21st century to be two feet smaller than present

models: Compacts down to 12 feet and standards to 16.)

Advanced engine designs such as the adiabatic diesel (which minimizes heat loss) and the stratified-charge engine (which features a 'rich' air-to-fuel mixture surrounding the spark plugs while maintaining an efficient and cleaner burning overall lean mixture) promise fuel economy improvements of 25-40 percent.³

Still further economies can be achieved by introducing Continuously Variable Transmissions (CVTs) such as those now in vehicles marketed by Subaru and Fiat, improved braking and idling now under study at the University of Wisconsin, reducing aerodynamic drag, and lowered tire rolling resistance.

According to Renner, the fuel efficiency of some cars now available is double that of the average new car on the road. Volvo, Volkswagen, and Toyota have production models that can achieve up to 100 miles per gallon with no sacrifice to safety and performance. Renner's analysis indicates, however, that there is no rush to introduce these vehicles commercially because of the oil glut and lack of consumer demand.

Improved fuel economy is of little concern when gasoline claims a relatively small share of the overall cost of operating a car. In 1986, gasoline and motor

2 Michael Renner, *Rethinking the Role of the Automobile*, Worldwatch Paper 84, Worldwatch Institute, Washington, D.C., June 1988, p. 26

3 Ibid, p. 31

oil accounted for only 15 percent of total operating costs per mile in the United States, down from 26 percent in 1975. Soaring insurance costs and maintenance expenditures have replaced fuel costs as the main concern.⁴

Renner believes that without strong government action, in the form of new standards and higher vehicle-oriented taxes, little further progress towards institutionalizing the next level of fuel efficiency will be made — despite his conclusion that technology exists or is on the drawing board to permit a 40-50 MPG standard for new cars at the turn of the century. (General Motors recently introduced a new —“GEO” line with claims of up to 50 MPG, although they will not release any estimates of expected sales.)

Renner cites the rising popularity of light trucks (“pick-ups”) whose fuel efficiency is one-third less than standard American passenger cars and whose total gas consumption more than doubled between 1970 and 1985. His pessimism seems justified by a recent article in the Wall Street Journal titled “Back to the Future: After Era of Blandness, Big and Glitzy Autos Are Making Comeback.” The article describes a new sales trend in bigger, more powerful, and elaborately styled vehicles with lower efficiency. Its accompanying charts show that inter-city travel by automobile is up, along with horsepower, while fuel

efficiency appears to be decreasing from its '88 model high.

No one believes the country is headed back to the days of the land ark, when huge Chrysler Imperials and 2 1/2 ton Cadillacs lumbered down the highways (the new De Ville is still 16 inches shorter than the 1981 version). But the current trend toward bigger and fancier has nonetheless set off alarms of consumer and environmental groups. For one thing, bigger engines, along with eating up more fuel, produce more pollution. And when horsepower goes up, critics contend, so does horseplay, with all the highway safety problems that portends.⁵

The signs are mixed. While remarkable increases in fuel economy are within our grasp, pressure to make them operational seems to be waning.

Emission Reductions and Alternative Fuels

A similar lag exists in respect to emission reductions. Renner cites strides made in cutting hydrocarbon emissions, carbon monoxide, and nitrogen oxide, but claims that conditions are now at a plateau.

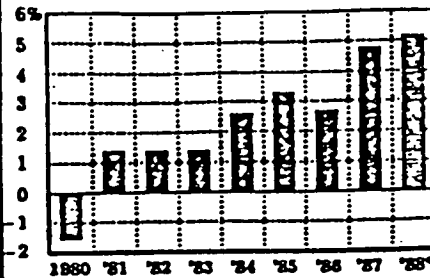
Air quality in the United States has improved, but the goal of clean air remains elusive. Even though U.S. emissions standards are as strict as any in the world, the nation's enormous traffic volume threatens to overwhelm pollution control efforts.

4 Ibid, pp. 33-34

5 Wall Street Journal, December 7, 1988, p. A1

Renewing an Affair With the Automobile

Americans are hitting the road,
Year-to-year percentage change in
intercity motor vehicle travel

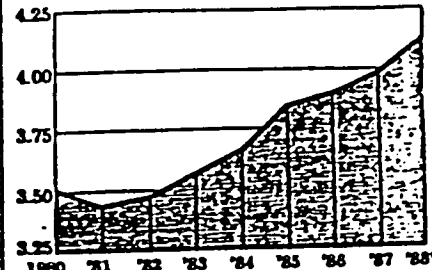


*Forecast

Source: U.S. Travel Data Center

In more powerful machines...

Average automobile horsepower per
100 pounds

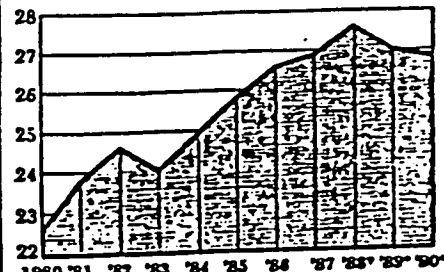


*Forecast

Source: National Highway Traffic Safety Administration

With less fuel efficiency...

GM's average fuel economy,
in miles per gallon

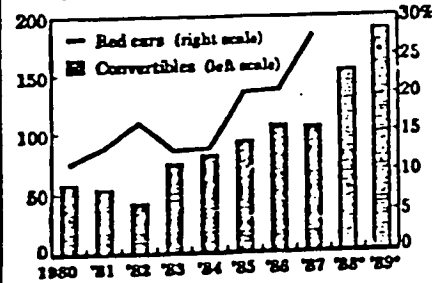


*Forecast

Source: General Motors

But more sex appeal

Convertible sales in thousands; red cars
as a percentage of compacts sold



*Forecast

Source: ASC Inc.; Do Post

Source: *The Wall Street Journal*, December 7, 1988, p. A8

The average daily ozone concentration in U.S. cities decreased by 15 percent from 1975 to 1981, but only half that much since then.⁶

While some fuel efficiency devices such as the stratified-charge engine promise to reduce emissions, Renner cites the lack of R and D resources to make them operational. As an incentive for alternative fuels which may reduce emissions, Congress did pass legislation in 1987 encouraging (through relaxation of fuel economy standards) automakers to produce vehicles that run on a mixture of ethanol or methanol and gasoline or natural gas and gasoline. This was strengthened by the 1988 Alternative Fuels Act which provides credits to automakers for cars that are capable of running all or partially on synthetic fuels. Several western states are considering legislation to mandate alcohol blends to reduce air emissions, and California has embarked on a methanol demonstration project in the hopes of making a major reduction in air pollution.

But the jury is apparently still out on the subject of whether alcohol blends actually improve air quality.

Both methanol and alcohol blends promise air quality benefits but also have drawbacks. Pure methanol yields only negligible amounts of highly reactive, ozone-producing hydrocarbons, but does

not noticeably reduce carbon monoxide emissions; methanol blends decrease carbon monoxide emissions, but do not provide any tangible benefit on ozone. Cars burning pure methanol also emit two to five times as much formaldehyde as gasoline vehicle do. Formaldehyde not only may cause cancer, but also is a very active component in the ozone formation process.⁷

The 1988 legislation requires EPA to analyze the impact of alternative fuels on both domestic air quality and global climatic change.

Renner believes that the greatest promise for reducing air pollution lies in developing vehicles powered by electricity or hydrogen.

Hydrogen may be the most desirable fuel of the future. It burns most efficiently in lean fuel mixtures, and is 15-45 percent more energy-efficient than gasoline. Unless the source is fossil fuels, the production of hydrogen does not lead to CO₂ emissions. Its use does not generate carbon monoxide or unburnt hydrocarbons, and emissions of nitrogen oxides are low. Similarly, if electricity derived from photovoltaics, wind, hydropower, or geothermal power is used, the generation of hydrogen through electrolysis does not entail any environmental cost.⁸

But Renner concludes that little in the way of research and development funds are available to make either

6 Renner, op. cit., p. 41

7 Ibid., p. 44

8 Ibid., p. 45

electric power or hydrogen operational in the foreseeable future, certainly not by the beginning of the century. Nor will there be pressure to do so if the oil glut continues or no significant legislation for further improvements in air quality is enacted.

The Kiplinger editors disagree somewhat and suggest that military-space research now underway could lead to civilian development of an electric powered automobile in the 1990s:

... a small, boxy electric car that weighs about 1000 pounds and can run about a thousand miles or so at top speeds of 100 mph without refueling, with efficiency equivalent to about 200 miles per gallon of gasoline. . . (powered by) an entirely new kind of storage battery employing a novel principle that promises high energy density and high discharge capabilities, although it would run at relatively low voltages, without environmental or other hazards to worry about.⁹

Even with this in prospect, the experts concur that gasoline, perhaps more efficiently consumed, will be powering the American automobile well into the next century. Cars may be lighter and smaller and, according to Kiplinger, loaded with new electronic gadgetry including satellite-guided navigation that may help in avoiding congested routes. Nonetheless, they will be

9 Op. cit., pp. 145-6

10 *Cars Overtake People*, March 1988

even more within the consumer's reach and there will be many more on the roads.

Implications for Montgomery County

Fuel efficiency improvements and electric vehicles notwithstanding, the prospects are for even more widespread vehicle ownership and use in Montgomery County by the next century.

A recent special report by the Greater Washington Research Center¹⁰ indicates that over half of Greater Washington's households now have two or more motor vehicles, up from 48 percent in 1980. As of 1986, 16 percent of the households had three or more autos. In Montgomery County, according to the draft 1990 AGP, 19.9 percent of the households are three-car families.

The metropolitan trend to multi-car households has accelerated with rising incomes, larger adult populations, and wider job dispersion. The GWRC comments:

Many of these jobs are next to impossible to reach by public transportation, and many more are easier to reach by car. . . . The continued strong commercial development of greater Washington is threatened by traffic problems and the difficulty in providing

enough space on the roads for one of humankind's most useful and accommodating tools. But will the romance between man and motor cool? For the foreseeable future it seems hardly likely.¹¹

What are the portents for Montgomery County? According to studies for the County's Comprehensive Energy Policy Plan, passenger vehicles registered to Montgomery County rose from 1.68 per household in 1976 to 1.99 in 1986. The number of registered trucks rose by 70 percent during that decade to 47,080, to some degree as a function of increasing job development in the County. All told, the 1986 ratio of fuel powered vehicles per household stood at 2.2, for a total of over 543,000.

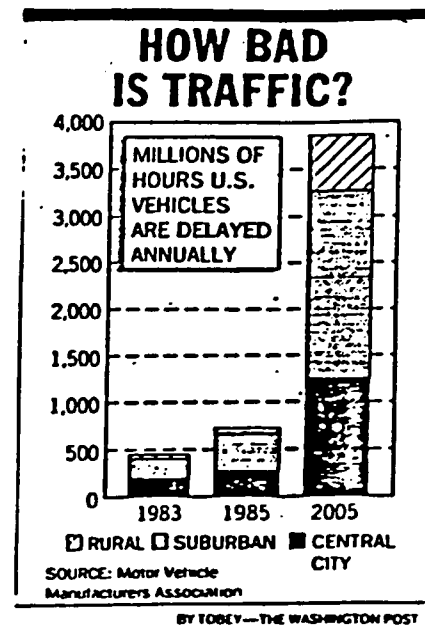
Scale of Growth

Let us be conservative and assume that the present relationships hold through the early years of the next century. The intermediate level COG household projection for Montgomery County in 2010 is 371,000, up 52 percent from 1986's 244,900. If new motor vehicles were added at just the same rates of today, cars, trucks, and motorcycles registered to Montgomery County households and businesses in 2010 would exceed 800,000, a 120 percent growth since 1976.

Added to the impact of these vehicles on County roads would be commuter and business traffic from

other jurisdictions, especially if the portent of a jobs/housing imbalance within the County is realized.

The clear implication of the numbers is that more vehicles=more traffic=more congestion. Although merely indicative, the accompanying graphic from a recent edition of The Washington Post portrays one estimate of expected national costs in terms of annual vehicle-hour delays if the trend continues — a debilitating prospect which the County will share with other suburban jurisdictions.



Source: *The Washington Post*, December 25, 1988, p. H2

**Montgomery County
Transportation Characteristics
by Planning Area, 1987**

<u>Area</u>	<u>% Households Owning 3 or More Cars</u>	<u>% of Workers Using Transit for Work Trip</u>
Countywide	19.9	12.0
Aspen Hill	25.1	8.7
Bethesda CBD	1.9	31.9
Bethesda-Ch Chase	16.4	15.2
Cloverly	43.7	2.8
Damascus	23.8	3.8
Fairland-White Oak	19.9	9.0
Germantown East	14.5	6.0
Germantown West	10.2	6.0
Gaithersburg East	15.9	11.3
Gaithersburg West	16.4	7.5
Kensington/Wheaton	19.4	10.3
North Bethesda	16.0	16.2
Olney	32.2	7.0
Potomac	38.6	7.8
Rockville	22.8	11.4
Silver Spring CBD	2.3	37.9
Sil Spg/Takoma Park	10.2	27.5

Source: FY 90 Annual Growth Policy Report, Final Draft

This is a prospect likely to occur whether or not innovations in alternative fuels are introduced to lessen the air quality impact of vehicle emissions. Air quality may improve, but the costs of congestion itself will be here to stay.

It seems highly unlikely that Montgomery County, or most other jurisdictions, will limit an individual's freedom to purchase vehicles, although increased traffic congestion combined with fiscal constraints on the County's ability to produce highway lanes could lead to consideration of "draconian" administrative measures.

Area licensing schemes, access fees to congested roads, fees for low-occupancy vehicles, and parking controls are being tested around the world with varying degrees of commitment and success.¹²

Montgomery County may ultimately move in that direction. The planning staff's background research for the Fy 88 Annual Growth Policy (*Alternative Transportation Scenarios and Staging Ceilings*), presented (p. 20 ff) over 50 specific recommendations for "Potential Mid-Term Traffic Alleviation Measures." These ranged from expanded ride-sharing, to transit subsidies, to taxes, parking fees, etc. Some have been adopted, and many more may be instituted as congestion worsens. Long-term comprehensive planning will need to consider such potential administrative adapta-

tions, and indeed be integrated with them. But the impact of the automobile may be more pervasive than can be addressed by administrative measures alone, especially those such as taxes and fees that will be vigorously opposed.

Evaluation of the land use and transportation directives in the comprehensive plan now under review should, therefore, afford an opportunity to consider more "systemic" approaches which make the physical pattern more conducive to alternative modes of commuting.

HOVs and Transit

One such approach would be institution of HOV lanes on the County's limited access highways, a measure with considerable promise if the anticipated growth of commuting from Frederick and Howard Counties and other outlying jurisdictions materializes along with up-county residential development. Renner comments on the energy efficiency to be produced by such efforts to encourage pooling.

...even a highly fuel-efficient car is inefficiently used when it carries only the driver, as is the case for over half the auto trips made in the United States; 87 percent of all trips have at most two passengers. Car-pooling and ride-sharing are still in their infancy compared with their potential. In 1984, the amount

¹² Renner, op. cit., p. 49

of energy used by U.S. cars for every passenger-mile of travel was just as high as back in 1971.¹³

The state of Maryland is now considering installation of HOV lanes on I-270 and Route 29, an effort which can be reinforced by estimates of long-term commuting flows and up County growth. Yet another candidate would be the Intercounty Connector. Indeed, the ICC will be especially important for HOV consideration as employment grows in the I-270 corridor and as commuting from Prince George's, Howard, and the eastern county intensifies.

COG recently modeled potential traffic impacts of HOV lanes on Route 29. Its projections indicated a net savings in the year 2010 over baseline conditions during the a.m. peak period of six percent in vehicle miles traveled and 10 percent in vehicle hours traveled. Significant increases in transit service and incentives were part of the packages studied, with results showing a six percent increase in person miles traveled and a 20 percent decrease in person hours traveled. The report indicated that this level of HOV performance would be contingent on a transportation management program for the corridor, including sub-

sidies to transit riders and discounted parking for pools in Silver Spring.¹⁴

HOVs can be a component in long-term planning if their value for traffic reduction is cost-effective in relation to administration, enforcement and the resultant lane restrictions of the particular expressway. But their significance is modest because of the limited number of potential routes and because traffic must use local roads to access and leave the system.

A far more significant and promising challenge for planning policy lies with public transportation and with shaping the County's residential and employment land use patterns to become "transit serviceable." Again, Renner portrays the nature of the challenge.

Re-orienting transport priorities can be successful only within the framework of a comprehensive urban policy. There is a symbiotic relationship between land use patterns and transportation networks. Public transit systems can facilitate and reinforce more compact land use, while land use patterns frequently determine transportation needs. For example, car dependency can be decreased by zoning ordinances that encourage a higher density

13 Ibid., p. 29

14 Metropolitan Washington Council of Governments et al, *U.S. 29 Corridor: Transit and Carpool Analysis*, July 1988

of urban activity while slowing development at the urban perimeter. The more concentrated both population and jobs are, the shorter are travel distances, the more mass transit becomes viable, and the more walking and biking occurs. In short, more compact cities foster less individual motorized transport.¹⁵

The County is considering a number of transit innovations which could improve service and reduce the impact of the automobile: the east-west transitway between Silver Spring and Bethesda; light rail service between Shady-Grove and Frederick; light rail or dedicated bus lanes along the Intercounty Connector; a people mover between Grosvenor Station and the Davis Tract. These may be able to move large numbers of people and prove more cost-effective than additional highway lanes over similar routes.

Witness the recent decision to institute commuter rail service in Northern Virginia. According to a Washington Post Article on November 15, 1988:

One reason for the new-found but widespread support for rail is relative cost. Start-up costs are expected to include about \$50 million for rail cars and locomotives and \$8 million for terminals, stations,

parking and land acquisition. The system would cost about \$16 million a year to operate.

Adding a lane to 58 rural miles of I-95 cost \$120 million five years ago, according to the Federal Highway Administration. Adding a lane today to the 50 miles from Washington to Fredericksburg, through an urban area with higher land costs, would cost considerably more.¹⁶

Additional light rail lines and more intensive bus service may help reduce the automobile's impact. But neither will reach its full effectiveness — nor may even be financially feasible — without greater concentrations of population and employment at more urban densities in their service areas.

Transit Serviceability

Montgomery County faces an uphill battle in creating transit serviceability for residential neighborhoods. As County growth has expanded outward from the relatively high density and transit-accessible down-county ring, automobile commuting has burgeoned. Drive-alone commuters were 66.1 percent in 1960 and 81.9 percent in 1987, the total volume held down only by the spectacular growth of Metrorail (from 11.1 million

15 Ibid., p. 51. It is worth noting that automobiles themselves are becoming more particularized and specialized, as the Kiplinger quote which began this paper indicates. Two- and three-car families seem to be purchasing different cars designed for errands, weekend use, carpools with the kids, etc. Efforts to discourage use of autos during commuting periods might keep more vehicles in driveways during the working day, but apparently people are beginning to do that anyway.

16 *The Washington Post*, "Va. Commuter Rail Plan Finally Picks Up Steam," November 15, 1988, p. A16

passengers in 1980 to 22.4 in 1987) and Ride-On (from 6.4 to 10.0 million during the period).

But the outlying areas of the County do not have direct or easy access to Metrorail, and Ride-On service, while improving, does not provide the dense and high-frequency network required for peak commuting periods. Indeed, as the Planning Commission's *General Plan Assessment Study* (p. 35) points out, many of the postwar subdivisions are designed for such privacy as to foil easy access by buses. Employment locations have dispersed to the extent, moreover, that many are accessible only by automobile.

The current pattern and portents for the future can be seen on the accompanying table taken from data in the 1988 Final Draft AGP. It displays household ownership of three or more cars by planning area along with transit use.

Overall, 19.9 percent of County households have three or more cars, and 12.0 percent of resident workers use transit.

With the exception of Aspen Hill, the highest proportions of three-car households are found in the lowest density planning areas with considerable development potential (Cloverly, Damascus, Olney, Potomac). The converse is true in respect to transit. Highest intensity of transit use other than in the two CBDs occurs in relatively dense areas with access to Metrorail and/or fairly extensive Ride-On and Metrobus service

(B-CC, Gaithersburg East, Kensington-Wheaton, North Bethesda, Rockville and Silver Spring-Takoma Park). But in Olney, Potomac, and the up-county planning areas with remaining growth potential, transit use is quite low. Interestingly enough, three of the policy areas with the highest multiple car ownerships (Aspen Hill, Cloverly and Damascus) are among the five designated as having no additional ceiling capacity for housing in the proposed 1990 AGP, because of road limitations.

A similar pattern may be seen in the work ends of the commuting trip. According to the JHK post-Metrorail studies, transit use in Bethesda, Friendship Heights, and Silver Spring with good Metrorail and bus access is 15 percent or more. According to the 1986 COMSIS studies of North Bethesda, a highly dispersed employment area even with its Metrorail access, commuting by transit was only five percent. Transit use at the Davis Tract in North Bethesda with over 4.5 million sq. ft. of office space developed at a Floor Area Ratio of less than .5 is under two percent for its 12,000 employees.

Planning Policy

County planning policy in respect to transit serviceability and densities has just begun to evolve and is not yet consistent. In the draft *Silver Spring Sector Plan*, for example, alternative scenarios call for a range of 1,200-3,750 dwelling units beyond pending and approved projects and between 400,000-1,100,000 sq. ft.

of additional commercial space, geared to capitalize on and reinforce the transit serviceability of the CBD.

But in the draft *Bethesda-Chevy Chase Master Plan*, new housing by 2010 over the entire planning area including the CBD is proposed as only 1,000 units more than in the 1988 pipeline, well below the proposed 1990 AGP ceiling — and this in the planning area with the second highest level of transit usage in the County.

The recently revised *Germantown Master Plan*, moreover, calls for significant reduction in potential density. Germantown today is at the low end of transit use. A major issue for debate in the revision of the *North Bethesda Sector Plans* has been the proposal to increase density of development at the Davis Tract, which would permit more options for transit ridership (including a people-mover to Grosvenor station).

Clearly many factors have been considered in formulating planning policy for these areas, and the increasing impact of the automobile on the County's future is only one. It has to compete with others for attention.

Each of the above examples happens to be a planning area where revisions to the guidance instruments have been recently completed or are in process. The County itself is far larger than these planning areas, however, as are the issues of density and transit serviceability

Montgomery County Transportation Characteristics by Planning Area, 1987

Area	% Households Owning 3 or More Cars	% of Workers Using Transit for Work Trip
Countywide	19.9	12.0
Aspen Hill	25.1	8.7
Bethesda CBD	1.9	31.9
Bethesda-Ch Chase	16.4	15.2
Cloverly	43.7	2.8
Damascus	23.8	3.8
Fairland-White Oak	19.9	9.0
Germantown East	14.5	6.0
Germantown West	10.2	6.0
Gaithersburg East	15.9	11.3
Gaithersburg West	16.4	7.5
Kensington/Wheaton	19.4	10.3
North Bethesda	16.0	16.2
Olney	32.2	7.0
Potomac	38.6	7.8
Rockville	22.8	11.4
Silver Spring CBD	2.3	37.9
Sil Spg/Takoma Park	10.2	27.5

Source: FY 90 Annual Growth Policy Report, Final Draft

The recent *General Plan Assessment Study* indicated that total potential build-out of housing under current zoning was 400,000 units. The study did not, however, present the range of densities at which the envelope could be built. That information can be obtained from

the computerized data base which provides an inventory of undeveloped land planned and zoned at various residential densities. While we have not seen the most recent records, our impression from past reviews is that the largest potential for new housing is on land at the lower — and least transit-serviceable — densities. If, indeed, this judgment is correct, then low density housing will continue to dominate Montgomery's shelter production well into the 21st century. Such a residential land use pattern will reinforce private vehicle commuting and exacerbate congestion — unless land and financing for new roads can be obtained.

Comprehensive Plan Review

These prospects suggest that the County must address the transit accessibility/density issue in the course of comprehensive plan review. The imperative exists, whether the County succeeds in narrowing the jobs/housing gap or whether we are to see even more decanting of residential growth to outlying jurisdictions. Indeed, if the jobs/housing gap widens, the County may be forced to encourage employment clustering so at least one end of the work trip becomes accessible to pools and transit vehicles. Clearly, conflict will occur between market-place demands for low-density residence, campus type employment complexes, and the County's need for a protective shield against automobile dominance. It is already occurring, and the planning process is where such conflicts need to be addressed.

What work needs to be done in addressing the issue?
We conclude with some suggestions.

1. **Location of employment and residential growth.** One logical direction, given the superb Metrorail system and its excess passenger capacity, is to encourage increasing amounts of residential and employment growth near the Metro stations or within easy access by bus or minibus transit. The problems are that undeveloped land accessible to Metro is limited; areas where land exists (North Bethesda, Wheaton) are under ceiling constraints because of present vehicular traffic levels; and in some locations (Friendship Heights, North Bethesda) citizen opposition to further densification is strong.

If new transit lines are opened, such as light rail to Frederick from Shady Grove or service along the Intercounty Connector, clustering at station stops or major highway intersections represents a long-term possibility for residence, employment or both. In some cases (the ICC) this may represent a conflict with current planning policies which merits attention.

These are all examples of competing planning objectives which may now need to be re-examined, given the clear prospect of automobile dominance.

2. **Density.** What is a transit-serviceable range of densities? Surprisingly enough, with all the national and local research on land use that the

issue has spawned, there are no tested guidelines. We are fairly certain that R-200 densities do not work, but at what level or at what density mix does accessibility by mini-bus or van begin to show promise? If the current development pattern of I-3 land (a major employment area resource) is at an FAR of 0.25 and discourages transit service, at what level does such service become viable but still permit "signature" buildings for corporations and a campus atmosphere? These are research questions which deserve treatment in comprehensive plan review.

3. **Retrofitting and redevelopment.** Except in the CBDs, the question of redeveloping existing uses to higher intensity has not been an issue. Maybe it is now, that congestion must be recognized as the price for low density. Elsewhere in the country large campus office parks on green fields (Princeton's Forrestal Center, Denver's Tech Center) are being retrofitted with new complexes in the interest of trip reduction and transit accessibility. Perhaps it is time to re-examine the I-270 corridor and other sprawling employment areas with transit serviceability and densification as priority objectives.
4. **Mixed uses.** Mixed use is a priority in the CBDs. There, an objective is creating viable 24-hour a day communities. Perhaps the time has come to examine use patterns elsewhere in the County

with the idea of integrating residences with work places and commercial areas — both to provide back-haul possibilities for viable transit service and to afford more opportunity for people to live where they work and work where they live.

5. **Transferable development rights.** Of primary importance as a technique of land use control and policy implementation could be the TDR, which the County has successfully pioneered as a technique for farm-land preservation. An initial proposal for testing appears in the General Plan Assessment Study:

Perhaps one could even conceive of property owners near transit points being allowed to purchase development rights from owners of properties that are not serviceable by transit, in order to concentrate employment and/or residential capacity near transit. Appropriate areas for such infill possibly could be designated as concentrated commercial, industrial and/or residential "receiving" areas, and other areas more difficult to serve by transit could be designated as "sending" areas.¹⁷

Since the automobile will be in the 21st century to stay "in spades" there may be some imperative to examine broadened use of the technique.

6. **Subdivision design.** One of the real "culprits" in the situation is the loop and cul-de-sac oriented pattern of subdivision layout that has

17 Montgomery County Planning Board, *General Plan Assessment Study*, January 1988, p. 31

dominated low density development. This impedes transit pick-ups not only for commuters but for school children and for elderly day care as well. The FY 88 transportation alternatives study has specific suggestions for this issue which merit attention.

Neighborhood street designs that thwart through automobile traffic should recognize the needs for inter-neighborhood transit, bicycle, and pedestrian paths. Internal subdivision streets not connected directly to nearby arterial roads could be provided in some cases with short connector roads reserved solely for buses, bicycles, and pedestrians. Adjacent subdivisions with their internal street systems not automobile-connected with each other could be provided with similar connector links. Even if such connectors are not provided at the time of development, right-of-way for such connectors should be reserved at time of subdivision.¹⁸

Montgomery County is one of the few suburban jurisdictions with a solid basis and a superior staff in urban design. The Planning Board, moreover, holds the power of subdivision review and approval. In the interest of taming the automobile, it should be possible to develop prototypes of transit-serviceable subdivisions, to establish guidelines for incorporation in the subdivision review process, and to instruct staff to work with developers to modify prevailing patterns.

18 Op. cit., p. 41

Concluding Note

If Montgomery County is to manage the auto glut in store regardless of any innovation in fuels and vehicle design, County citizens will need inducements and constraints sufficiently compelling to change current behavior. This is a tall order, and officials may be understandably reluctant to move too far or too fast. There are, nonetheless, precedents and "goal models" elsewhere to sustain the effort. While this community can probably not aspire to the extent of transit ridership and compact land use patterns as a London or Paris, there is the example of Metropolitan Toronto. The County studied Toronto in its initial planning for uses adjoining Metrorail. In the suburb of North York, where automobile ownership is high, business parks near Metro stations now evidence a 20-25 percent modal split which planners are seeking to expand. Toronto jurisdictions have combined tough land use policies with superior transit service to constrain vehicular use, and the public has responded. Perhaps it is time to re-examine that context for lessons.

As of 1988, the County's land use and transportation approaches may well be counterproductive to control of the automobile in the 21st century. Comprehensive plan review affords opportunity to re-examine these approaches and provide some ultimate relief.

Chapter 5

Telecommuting and Home-Based Work and Montgomery County

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TELECOMMUTING AND HOME-BASED WORK AND MONTGOMERY COUNTY

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As the world of high-tech comes to dominate new developments in American business there is an ironic twist: cottage industry is reasserting itself. The tools are not the adze or the Singer sewing machine, but IBM PCs and comparable computer hardware, the fax machine, and courier services such as Federal Express and UPS. The products are not durable goods, but infor-

mation and services. A growing roster of books, articles, newsletters, associations, electronic networks — and even a weekly national radio program broadcast from Prince George's County — all point to the clear upward trend in "telecommuting" and other forms of home-based work.

The cottage information industry is not a fad. Indeed, one state whose settlement pattern epitomizes suburban sprawl and whose overall air quality exceeds hazardous levels has launched major demonstration projects to explore the feasibility of HBW (Home-Based Work) as relief. The Los Angeles area's regional association of governments (SCAG), the City of Los Angeles and the State of California are all testing whether HBW holds promise to alleviate congestion, improve air quality and save the government substantial sums by reducing need for capital investment in centralized office space.

Definitions and Terms of Reference

Close to one out of every five households in the United States has some sort of part or full-time income-generating activity that involves at least one homemaker. Thomas Miller, Director of Research in the Home Office Research Division of LINK Resources Corporation identifies four principal components in this universe.

Home Business Operators. Estimates range from 3-10 million people (LINK Resources) to 13 million (The American Home Business Association) whose schedules may involve working from home 14 hours a week or more. According to a November 1988 press release from the AHBA, a million home-based businesses are started in the U.S. annually.

Freelancers. These are perhaps 2-8 million individuals, some of whom may be among the home business group. Others are "moonlighters" or contract workers. Freelancers, according to Miller, are "notoriously fluid" in terms of self-definition and numbers. Some are in between more formal jobs, some are "double-dippers," supplementing their social security, pension and other retirement income, while others are exploring part-time or transitional at-home work styles, for example, while caring for young children.

Corporate Employees. Estimates range from 14-16 million, a majority of whom put in an average of 11 hours a week or more in "after hours" work at home. Others may be freelancing or operating supplementary home-based enterprises of some sort unrelated to their regular employment.

Corporate Telecommuters. These number perhaps 2-4 million, who spend 8 hours a week or more — very few as much as full-time — working at home. These individuals have full-time jobs, at least portions of which are accomplished at home under formal arrangements with their employers.

The numbers illustrate the broad array of occupational arrangements that fall into the category of HBW. They also indicate that the conventional telecommuter, i.e., one who operates with "the partial or total substitution of telecommunications, with or without the assistance of computers, for the twice-daily commute to work"¹ comprises a relatively small portion of the pool.

The work place arrangements themselves are as varied as the occupational characteristics. Gil Gordon, a management consultant who specializes in helping businesses implement telecommuting, defines telecommuters as

office workers who work off-site or at home for 2-4 days a week . . . instead of . . . everyone in a central place.²

Telecommuting may focus on a local work center near the employee's home, referred to as a "satellite" when

1 The term "telecommuting" was coined by Jack M. Nilles during a National Science Foundation-funded research Project, "Development of Policy on the Telecommunications-Transportation Tradeoff," Report NSF-RA-5-74-020, University of Southern California and the National Science Foundation.

2 Gil E. Gordon, Working memo for J.L. Bohart & Co., June 1987, p. 1

associated with a single corporation such as a large insurance company or a "neighborhood work center," when subsidiary space is shared by several organizations. These arrangements are distinguished from branch offices or decentralized back-office operations in that proximity to employee residences dictates the choice of location. Nilles identifies yet another setting where employees continue to use or have space in a centralized office but, by virtue of part-time HBW, do their commuting fewer than five days a week and at off-peak hours.

Job Types

Considerable research has gone into identifying the types of activity that lend themselves to HBW and the range of occupations for which a home setting is conducive.

A recent article in *The Futurist*³ stresses tasks that are not location-dependent, including:

routine information handling;

high daily or weekly use of the telephone

relatively little face-to-face personal contact or personal contact that can be scheduled so that cognitive tasks can be handled from a remote location;

work that can be accomplished on computer terminals;

project-oriented job activities with tasks involving a structured flow of information in a defined time frame;

defined milestones or deliverables at specific times;

work that can be performed independently of others and later integrated into a whole;

minimal need for complex support in terms of people or multiple types of equipment and materials such as files;

minimal need for working space.

In terms of occupations themselves, the AHBA and Kelly cite a wide array of white-collar professions and services. We list many of these below because, in aggregate, they could have profound significance for a developing metropolitan community such as Montgomery County:

Consulting services (management, hi-tech, financial, communications, marketing and public relations); accountants; veterinarians; manufacturers' representatives, publishers; writers and editors;

3 Marcia M. Kelly, "The Work-at-Home Revolution," *The Futurist*, Vol. XXII, no. 6, November-December 1988, p. 31

systems analysts; psychologists; doctors; dentists; contractors; data processors; engineers; designers; commercial artists; market researchers; caterers; real estate agents; photographers; tutors; appraisers; income tax preparers; mail order specialists; travel agents; sales (catalog order takers or reservation clerks; lawyers; purchasing agents; secretaries; bank officers (finance, credit, calling officers); architects; insurance agents; counsellors (vocational or educational); personnel/labor relations (job analysts, applications processors), etc.

Trends and Profiles

The recent net increase in home-based workers has been astonishing. Nationwide there are over 18 million households with close to 25 million homeworkers, almost 10 percent of whom have joined the rolls in the last 12 months.

This represents an average annual increase of 6.9% in the homemaker population and 16.3% in households. A key factor in the growth trend is a major influx of new homeworkers . . . totaling 2.4 million. This is a very dramatic increase over the one million 'first time' homeworkers identified in 1987.⁴

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- 4 Thomas Miller, LINK Memo 009, July 1988. Net increase in home-workers was actually somewhat smaller. The Miller survey showed that some 800,000 individuals stopped working from home during the same period. This illustrates the volatility and often temporary nature of home enterprises.
 - 5 AHBA press release, November 10, 1988

Miller's survey showed that more than 58 percent of the new entrants were under 35 years of age. A total of 56.6 percent were female. New homemaker households average 1.9 children under 18 per household, 66.7 percent of whom are under age 6, statistics which underscore the child care significance of much home-based employment.

The profile of the home-based business owner is somewhat different.

Membership in the American Home Business Association is 65 percent male and 35 percent female. He or she is 38.8 years old, is married and has two children. His income is \$56,000 per year. He owns his own home and is a college graduate. He has worked for a large corporation for a number of years.⁵

About 6 million homeworkers — almost one quarter of the total — are full-time at the task, an increase of 22 percent between 1987 and 1988. As an overall average in 1988, homeworkers spent 19.8 hours a week actually working in their residence, up from 14.2 hours in 1987, according to Miller. Nilles' estimate for the home telecommuter segment, whose jobs involve a "normal" mix of solo activity and face-to-face interaction at a

headquarters location, is between one and two "equivalent days per week."⁶

Miller projects the number of homeworkers will grow to 30.8 million by 1992.

Nilles cites estimates that over 1,000 U.S. companies — widely and sparsely scattered — employed telecommuters in 1987 and suggests that this represents a mere fraction of ultimate potential. He believes that current trends might result in more than 20 million employees (as distinguished from consultants and other independents) working from home by 1995, about 40 percent of them, part-time. Lack of data, he says, makes it impossible to speculate further. He believes the factors that determine future growth will be more sociological than technological.

The Downside of HBW

While HBW offers considerable benefits to individuals (independence, reduced commuting, help with child care considerations, reduced costs for office space) and

to some corporations (worker retention, savings in office space⁷), there are downsides as well, and HBW is not for all people or all jobs which fit the occupational profile.

First of all, many corporations that might be likely to use telecommuters are reluctant to do so because of anticipated loss of employee "control" and face-to-face contact. A Special Report in *Business Week*⁸ quotes Bell Communications official, Robert Kraut, to the effect that "home-based workers earn about 70% of what their full-time office counterparts make." The same article cites a home-based legal librarian whose income as a telecommuting contractor matches what he might receive in a prominent law firm, but at the price of much longer hours and less freedom to take vacation breaks. "Burnout" can occur just as fast or faster at home. Moreover, experience has not yet established what effect telecommuting has on the career advancement of the employee who works outside the organization.

Edwards and Edwards⁹ indicate that HBW is unsuited to personality types who have a history of conflict at

6 Nilles, op. cit., p. 301

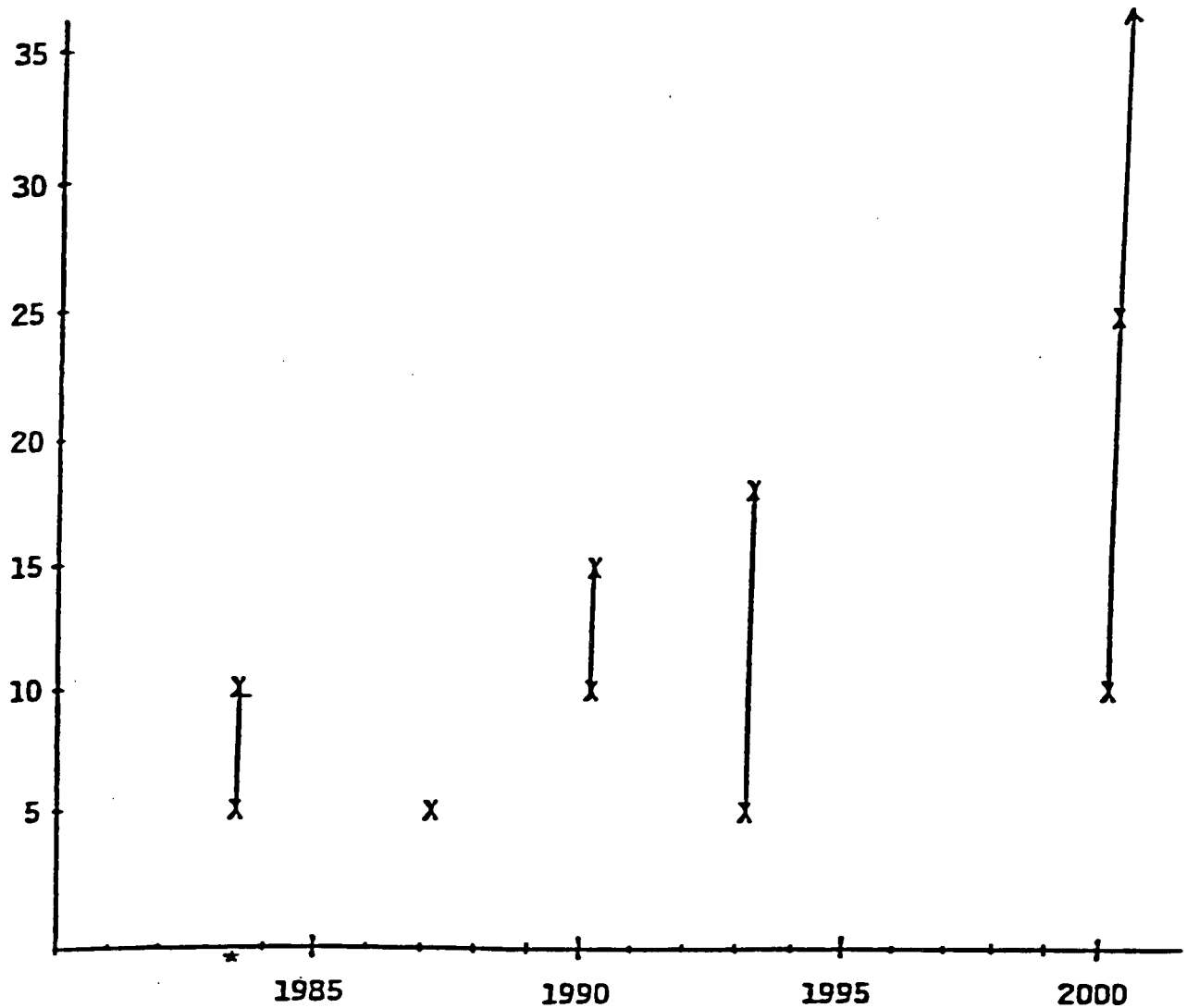
7 This is by no means universal, however. Kelly states that even full-time teleworkers need to be brought into the office occasionally, for review, new assignments, and business and social contacts with fellow employees. Space needs to be provided, but savings can be achieved through shared desks and less costly satellite quarters in suburbs rather than in central cities.

8 October 10, 1988, p. 106

9 Paul and Sarah Edwards, *Working From Home*, Jeremy Tarcher, Los Angeles, 1987, Chapter Two.

ESTIMATES OF THE TIMING AND EXTENT OF TELECOMMUTING GROWTH

Millions of telecommuters



* Estimates of the number of "home workers"

Estimates for other years are for "telecommuters"

THE EFFECT OF TELECOMMUNICATIONS SUBSTITUTION
ON YEAR 2000 VEHICULAR TRAVEL CHARACTERISTICS
SCAG URBANIZED AREA, AVERAGE WEEKDAY

<u>TRIPS (HOME-WORK)</u>	<u>w/out telecom:</u>	<u>with telecom:</u>	<u>% Change</u>
Person Trips	9,236,198	8,223,184	-11.0
Driver Share	79.5%	79.7%	.3
Passenger Share	11.4%	11.5%	.9
Transit Share	9.1%	8.8%	- 3.3
<u>TRIPS (OTHER-WORK)</u>			
Person Trips	4,341,630	3,882,147	-10.6
Driver Share	88.2%	88.6%	.5
Passenger Share	9.6%	9.1%	- 5.2
Transit Share	2.3%	2.3%	0.0
<u>TRIPS (ALL PURPOSES)</u>			
Person Trips	50,810,969	49,338,472	- 2.9%
Driver Share	68.9%	68.6%	- .4
Passenger Share	27.4%	27.8%	1.4
Transit Share	3.7%	3.6%	- 2.7
Average Freeway Speed Per Vehicle Trip (mph)			
A.M. Peak	31.00	36.00	16.1
P.M. Peak	31.00	33.00	6.5
A.M. Peak Average Vehicle Delay in Minutes	6.60	4.50	-31.8
Average Travel Time in Minutes	15.10	14.95	- 1.0
Overall Auto Occupancy	1.397	1.406	.6
Total Vehicle Miles Traveled	304,051,000	293,644,000	- 3.4
A.M. Peak	39,177,000	36,468,000	- 6.9
P.M. Peak	89,971,000	78,647,000	-12.6
Off-Peak	182,903,000	178,529,000	- 2.4
Total On-Road Motor Vehicle Fuel Consumption (millions of gals. per yr.)			
Gasoline	3,672	3,546	- 3.4
Diesel	857	846	- 1.3
Tons Pollutant per Day from On-Road Motor Vehicles			
Reactive Organic Gases	319	305	- 4.3
Nitrogen Oxides	474	465	- 1.9
Sulfur Oxides	41	40	- 2.4
Total Suspended Particulates	95	92	- 3.2
Carbon Monoxide	3,352	3,208	- 4.3
Miles of Congested Freeways	118	80	-32.2

Sources: SCAG; Travel Forecast Summaries; Year 2000 with 2000 Systems (1983 RTP with and without telecommunications); Technical Memorandum No. 3/PA/8301.04; March 18, 1983.

SCAG; Draft Environmental Impact Report, Regional Transportation Plan; Tables IV-3 and IV-7.

Note: A.M. Peak (6:30-8:30); P.M. Peak (3:00-6:00)

As for the overall trip statistics shown in Table 2, it is seen that overall person-trips decrease by about 3 percent. Overall mode shares, again, change only slightly. Average peak period freeway speeds increase in both a.m. (16.1 percent) and p.m. (6.5 percent) peaks with telecommunications substitution. Average delay per vehicle in the a.m. peak decreases markedly (31.8 percent) with telecommunica-

Source: Southern California Association of Governments, *The Telecommuting Phenomenon: Overview and Evaluation*, March 1985

home or who require frequent supervision and encouragement from co-workers and bosses. Some young singles who have tried it find they need the office social life more than they enjoy the independence of working on their own.

The same writers, though strong advocates of HBW, somewhat dampen the enthusiasm for embarking on it as a means of combining work and child-care:

Some people can and do work while caring for children under six years of age, but since infants and toddlers need constant supervision, want and demand your attention, and try to be part of everything going on around them, most people find this unsatisfactory . . . When working parents care for toddlers and preschoolers at home, the typical result is that little work gets done and/or the parents end up expecting the young children to behave in ways beyond their abilities. This usually leads to a flood of yelling and unpleasantness. It can also result in emotional or behavior problems in the children.¹⁰

There are issues of planning, selection of employees and managers to participate in telecommuting options and training of both. Issues of equity may center around managers' selection of certain individuals to receive the perceived benefits of telecommuting; or the converse, perceived reduction or loss of fringe benefits for telecommuting workers as compared with in-house employees doing the same types of work.

10 Ibid, p. 292

Opposition of organized labor could grow, some writers feel, in proportion to the perception that firms are reducing in-house workforce, preferring to subcontract information work to home-based independents as a means of evading fringe benefit obligations. The Internal Revenue Service, too, has an interest here. IRS has already begun to crack down on the practice of firms' classifying off-site employees as self-employed contract workers in order to avoid payment of federal employee taxes and Workmen's Compensation. HBW will probably increase, but the jury is still out on whether the reality will match the potential that advocates contend.

Impact on Commuting and Air Quality — The California Experiment

The State of California, Los Angeles City and its regional association of governments (SCAG) have adopted formal policies to encourage telecommuting and HBW as a means of mitigating increasing traffic congestion and air pollution. The concept is to reduce peak hour automobile trips through having more workers — both government and private — do their assignments at home. Governor Deukmajian authorized, among other measures, the Department of General Services to expedite a telecommuting demonstration project for state employees. His Executive Order states:

Whereas, in the urban areas of California, commuters are spending approximately 400,000 hours daily in traffic jams, and during the next 12 years another six million vehicles will be added to California's streets and highways, and while expansion of streets and highways remains the cornerstone of reducing traffic congestion, nonetheless there will still be insufficient roadway capacity to accommodate this increased traffic.¹¹

The SCAG effort, which started with a small demonstration involving 18 public employees working full or part-time at home, is about to be scaled up ten to twentyfold as initial steps toward a regional target of removing 3,000,000 vehicle trips from the LA roads by the year 2010 through HBW and other telecommuting arrangements. SCAG consultants analyzed transportation, energy and air quality impacts of a 12 percent reduction in work-related travel in the year 2000. Their calculations are shown in the accompanying table. It is important to note that SCAG's fundamental assumptions reflect the sprawling land use pattern of Southern California and that the modal split for transit projected for the turn of the century is only three-quarters what Montgomery County residents average for home-to-work trips today.

The State's telecommuting effort is also seeking to reduce governmental office space needs and capital costs in the process. Although, the pilot projects have not yet yielded a basis for firm estimates on how much can be saved, both State and regional authorities believe

significant reductions can be made through a combination of telecommuting based in employees' homes and satellite offices in less-expensive space accessible to concentrations of worker residences.

Hawaii, Florida and Washington States have, apparently, made inquiries about these pilot studies. They may be examining telecommuting programs like California's.

Implications for Montgomery County

Montgomery County is not Orange County, California. It has achieved a relatively compact land use pattern compared with many suburban jurisdictions. A Metrorail, Metrobus and Ride-On transit system is in place and generating work-trip ridership of 12 percent, according to the Draft FY 1990 AGP (although outlying and less dense sections of the County evidence much lower transit use). Administrative measures encourage ridesharing in car and vanpools and provide transit subsidies. The County has a strong general plan and area plans which direct development and an annual growth policy which manages its timing in relation to availability of adequate public facilities. California's serious fascination with telecommuting and HBW is directed toward achieving by the year 2010 what Montgomery County enjoys today.

11 Executive Order D-73-88, September 3, 1988

Nonetheless, some aspects of the County's long-term future could make telecommuting and home-based work attractive as a planning option. Any approaches which reduce vehicle-miles traveled per person, lessen automobile commuting during peak periods, relieve congestion and help improve air quality in the process, are worth considering — perhaps, even trying out. This applies especially for less dense planning policy areas that are not transit serviceable today and are unlikely to be so in the future.

If the jobs/housing ratio continues to grow, telecommuting might appeal to Montgomery County firms as a means of permitting more workers to live in outlying jurisdictions in less costly housing while minimizing the impact of work-trip travel on County roads. Montgomery County employers depend heavily on women, who constitute a high proportion of the labor force at the very time when child care services are being strained. More home-based work might ease this crunch.

The first problem with assessing the potential for HBW and its implications for Montgomery County, however, is that there are absolutely no data to enable taking the measure of current HBW and telecommuting activity in the County. . . or their respective impacts. Both are probably occurring to a considerable extent in 1989.

The second problem is that a major amount of HBW in the next generation is likely to have even more significant, and not altogether beneficial, impacts on both

the County's fiscal base and its land use regulatory structure. While such implications appear not to be examined in the literature of HBW advocacy, they are nonetheless important in determining how Montgomery County wishes to respond to what is clearly a national trend and whether the County wishes to foster or hasten its progress..

Fitting the Profile

The residents of Montgomery County fit the HBW/telecommuting profile like the proverbial glove — so well that it is highly likely some substantial proportion of the workforce here already telecommutes or works at home full- or part-time. There is a strong component of information work in the leading sectors of economic activity. The educational level of the residents is extraordinarily high. Office automation is well-established. Large numbers of consultants, psychotherapists, freelance writers, artists, public relations specialists and other occupations that lend themselves especially well to home work are represented. A quick, and admittedly random, scanning of the Yellow Pages in some of these categories revealed many addresses not readily identified as business district locations.

There is a significant population of well-educated retirees from the government and military services and a high rate of labor force participation by women — a substantial proportion of whom are professionals and in their childbearing and childraising years. In addition, the computer services industry, a leader in telecommut-

ing practice, is one of the most rapidly growing in the area.

It is a very common experience to be told, when telephoning someone at a government office or private institution, that the person is working at home that day and can be reached at a different number. A computer systems consultant based in a Bethesda CBD office near his home operates as a telecommuter when servicing certain out-of-town clients. A Rockville computer services company responds, "Sure we have telecommuters."

Anecdotal data abound, supporting our hunch that there are a lot of HBWs out there. Unfortunately, that's about as far as one can go. Neither COG, nor any local jurisdiction in the Washington region, has yet considered HBW seriously enough to assess its current scale. With this disclaimer as an introduction, let us offer some conjecture.

Scenario I: Traffic Reduction Impacts

COG's Round IV intermediate employment projections for the metropolitan region in 2010 estimate 2.35 million jobs in those sectors most likely to lend themselves to HBW as employers, contractors or workers, i.e., Transportation, Communications, etc.; Wholesale Trade; Finance, Insurance, etc; Business Services; Other

Services; Member Organizations; State and Local Government; Federal Government; and Self Employed.

Let us assume that, in line with COG's overall projections, 17 percent of these jobs are in Montgomery County. Let us further assume, conservatively, that 10 percent will be home-based or telecommuting positions not currently represented in Montgomery County's current at-place employment. This amounts to 40,000 new worker-slots.

If the workers filling these jobs evidence travel patterns comparable with national trends for telecommuters, they would work from their homes an average of three days a week and appear at offices within the County two days a week. This suggests an average saving of 24,000 person trips (6 percent) on any given day, assuming the saved travel is distributed randomly throughout the week.

Not all of these would normally be single-person automobile trips. Let us thus reduce the figure by 12 percent for potential transit passengers, two percent for car-poolers, and five percent for people who might otherwise be on flex-time or part-time schedules.

The net result of this scenario would be savings, on an average working day, of some 19,400 trips. In and of itself it is a significant figure, comparable for example,

with the number of commuters from Kemp Mill-Aspen Hill-Kensington-Wheaton to downtown Washington.¹² Trip reduction on this scale could make a difference — entirely depending, however on whether HBW residences were concentrated or dispersed and which travel routes would be relieved. If HBW and telecommuting replace work-trips scattered throughout the County, their travel reduction impact might be negligible. Similarly, if they replace already-efficient travel, e.g., by Metro or vanpool, leaving the single-passenger automobiles on the roads. And if they result in a net increase of non-work trips or travel miles by service/delivery trucks, then their other values might be offset entirely.

A useful test of the significance of orders of magnitude would be the case of Silver Spring CBD. According to the FY 1989 Annual Growth Policy, there are 31,300 jobs there now and a ceiling which will allow 12,500 more jobs to be added. Let us assume measures contemplated under the county's current transportation management program will be able to achieve the AGP policy objectives of 25 percent of the work-trips by transit and an average occupancy of 1.3 persons per private vehicle. Out of 12,500 workers, this would mean 3,125 coming by transit and 9,375 by private vehicle, foot or bicycle. If the single passenger automobile share of these new

trips can be reduced to the 40 percent range, part way between the 48 percent achieved at the Nuclear Regulatory Commission headquarters in North Bethesda and the 33 percent monitored in Washington, D.C.'s Metro Core,¹³ there would be 4,125 worker-trips in carpools or vanpools and 5,250 single passenger vehicle trips. If a special telecommuting effort focused on the hard-core drive-alones were to convert 20-30 percent of them to home-based workers on a full-time basis, 1,000-1,500 work trips into the Silver Spring CBD might be saved. Even if the telecommuting from home were on a three-day-a-week basis distributed evenly throughout the week, it might spare 400-600 daily auto trips entering the CBD. For an area where the peak hour road capacity within the critical cordon district is 18,000 vehicles, a saving of 500 peak hour work-trips would amount to a little under 3 percent of total peak hour traffic volume.

But we have been talking only of new jobs yet to come in this illustration. If a telecommuting program were extended to, say, 3,000 single-occupant auto commuters from among the 31,300 workers now employed in the Silver Spring CBD, a 60 percent or three-day-a-week saving of work-trips would be 1,800 or 10 percent of the area cordon capacity.

12 According to figures from the County's 1984 Census Update.

13 Kirby, Ronald F., and Neuman, Christopher R., "Solo Drivers Hang Tough," in Metropolitan Washington Council of Governments, *The Region*, Winter 1987, vol. 28, no. 3, p. 7

Reality is clearly not so simple, but this order of magnitude might make some sort of demonstration project quite worthwhile, especially since further speculation on factors relating to traffic reduction and other impacts is foiled by lack of current baseline information.

Scenario II: The Federal Government and HBW

Montgomery County has a few large private companies and data-centered corporations that might (or might not) be likely candidates for corporate telecommuting. The County's largest employer, however — the Federal Government — is undergoing transformation that could very well include HBW and other forms of telecommuting as part of its own development scenario for the national capital area.

Throughout the 1980s, much of the region's suburban employment growth has resulted from federal policy shift toward contracting out work rather than hiring additional government personnel. Efforts to deal with the national deficit may well bring about major changes in the physical arrangement of federal personnel and operations themselves.

Many of the leases for private office space occupied initially by federal agencies during their expansion wave of the 1960s are expiring. In the face of enormously rising downtown land values and rents, the General Services Administration is under great pressure from Congress to reduce the cost of providing office space for

federal workers. The Federal Government will have to resort to new expedients.

One, which has already affected Montgomery County, is to purchase rather than rent new buildings for federal agencies, or to negotiate leases on buildings that will pass into federal ownership at the end of their respective lease periods. Another is to develop space on land already owned by the Federal Government.

But the amount of space is at issue, too. GSA has been directed to adhere to greatly reduced standards of office space per employee, which could be met — in part — by a telecommuting program. What California has started to investigate at the state level, could well become significant in the Washington area for economic reasons.

If the Federal Government were to make a major initiative toward instituting telecommuting, Montgomery County would surely feel the impact. Proposals to redefine the "Federal District" officially, for the purpose of siting federal operations, are before Congress.

With a little imagination, one can envision not only home-based telecommuters but federal telecommuting centers (satellite or regional) in County locations especially well served by transit (such as Silver Spring, Bethesda, North Bethesda and Rockville), equipped with videophones or two-way fiber optic equipment for conferencing plus computer stations, where suburban and exurban commuters might come to work full-time

or part-time, within easy reach of downtown base of-fices and much shorter commuting time from their homes.

Two more recent events add credibility to this prospect. The Federal City Council and the National Capital Plan-ning Commission have commissioned papers address-ing, among other matters, the subject of long-range telecommunications planning for the Federal Govern-ment. One of these papers, prepared by the retired chair-man of AT & T, dealt explicitly with the implications of telecommunications on planning the structure of the nation's capital over the next half-century. As a follow-up, NCPC is supervising a contract with an MIT team to develop a prospectus for a series of long-range planning studies related to the federal interest and the national capital. Completion is scheduled for June 1989. Montgomery County would do well to keep abreast of its recommendations.

Scenario III: Private Sector Construction Impacts

If Montgomery County were to have 40,000 new telecommuters in office-type jobs by the year 2010, this could reduce office space occupancy and, possibly, the volume of anticipated new office building construction.

Gordon, Kelly, and the SCAG studies do not make an exact correlation between employee time out of the of-fice and reduced work space, but for sake of illustration let us assume a 50 percent/worker space savings. At a reasonable standard of 200 sq. ft. gross/worker, a fifty

percent reduction for 40,000 workers would amount to four million square feet of office space which would not have to be occupied for this level of employment.

We can not know whether this result in vacated space in existing buildings or new space that would not need to be built. The two possibilities would affect the con-struction sector differently. For the moment, however, let us assume that the space savings would all relate to new construction.

This corresponds roughly to one year's worth of office building construction in Montgomery County at 1982-86 completion levels. At a construction cost of \$150/sq. ft., it would amount to some \$600 million in foregone in-vestment.

Here, we begin to see some of the downside aspects of mass telecommuting which will need to be factored into County planning policy. Let us further assume that the space saved would otherwise be in private sector offices or, if government, leased from private developers. At last year's rate of \$2.172 per \$100 valuation, this would amount to something on the order of \$13 million annual-ly in revenue the County would not collect. Clearly the bite would not be so great, if the reductions affected Class B space.

The illustration points up the fact that revenue ques-tions matter enough to be addressed — along with traf-fic implications and child care impacts — in assessing

the value of large scale HBW/telecommuting in Montgomery County.

Other Economic and Fiscal Considerations

Home-based enterprise is little noted for its role in the County's economy. It has been a helpful safety valve during times of federal reductions-in-force and general recession. Professionals finding themselves out of work have been able to piece together some livelihood consulting for former employers, helping colleagues with overflow work, writing, teaching or trying out something altogether new.

In many respects, the service of Montgomery County's homes as incubators for start-up businesses has gone unrecognized. Ability to operate with minimal overhead expense is often critical to these enterprises in their early stages. For more established operations, overhead costs can make considerable difference in the degree of profit. Most home-based businesses are relatively small in scale and, in many cases, they generate part-time or intermittent income. However, in the case of profession such as law and medicine and certain consulting practices which are well represented in the County, incomes generated in the home may be quite substantial. The role of public policy in enabling home-based businesses to enjoy low overheads is rarely acknowledged.

Zoning codes and residential property assessment policies result in subsidies to the cost of occupying space for income-earning activities in the home — ex-

cept for those which operate under special exceptions. Zoning classifications help maintain a land value differential between commercial and residential properties. Even if a potential home-worker buys a larger house than would otherwise be needed, the cost of residential space will virtually always be lower than the cost of equivalent space in a commercial facility. Property taxes on the higher-valued commercial space will be proportionately higher as well, and, in some urban districts, subject to additional surtaxes.

Unless a home-based income activity visibly changes the exterior of the house or has secured a special exception, the state assessors for Montgomery County do not take the non-residential use into consideration in appraising the property for tax purposes. Income generating residential uses (such as accessory apartments) are accounted for in assessed valuation. Income-generating activities in institutional properties (nursery schools in churches, for example) are also taxed. But not telecommuters, consultants or real estate agents whose operations the appraiser cannot see from outside the house.

Equipment and furniture in a home office used for income generating purposes may also be unrecognized when it comes to the personal property tax that would be assessed if it were utilized at commercial and industrial locations in the County. Unlike Virginia, Maryland does not tax household personal property.

Home-based workers may also be eligible to take advantage of Federal Income Tax deductions for expenses

related to home offices. Masking the income-generating activity in the residential property may enable the home-worker to pay for such services as insurance, telephone and trash collection at preferential residential rates, and thereby enjoy additional savings. Moreover, resident workers can benefit from use of free County facilities such as the public library system, which is an important — and economically valuable — component of the supporting infrastructure for information work.

Somewhat mitigating these potential losses in revenue as the result of current practice, is the fact that Montgomery County does derive revenue through the piggy-back state income tax on incomes earned through various HBW activities. Also, other County businesses gain through purchase of goods and services by HBWs. Absence of data makes it very hard to estimate the balance of factors.

Neighborhood Impacts

The desirability of learning more about the role that HBW can play in the County's economic base holds more than academic interest now, when the County is considering modifications to the zoning regulations which affect home employment. If HBW and telecommuting become very widely adopted, the practice could have considerable impact on the structure of County neighborhoods, giving far greater importance and scope to the task of reexamining the ordinance than currently conceived.

It is one thing for an occasional psychiatrist or public relations consultant to work at home. It is quite another if large portions of blocks or neighborhoods host cottage-based industry.

The results could be quite positive. Edwards and Edwards cite considerable advantages to improved neighborhood security when household members work at home during the day. Certainly the practice could introduce some liveliness into County neighborhoods that are deserted from 8:00 a.m. to 6:00 p.m., and it could alleviate peak hour traffic jams from the neighborhoods into the major arterials.

But there could be a downside as well, i.e. increased intrusion of business-oriented traffic and disruption of tranquility. Impacts on property values could be adverse in two different ways. If the nature of practices can not be controlled, values could be lowered. And if purchasers bid up the market, anticipating extra income from HBW to offset inflated prices, the housing affordability problem could grow even worse for families unable to benefit from HBW — especially such worksite-bound civil servants as teachers and policemen.

Concluding Note

It is not inconceivable that as much as 20 percent of Montgomery County's work force could be full or part time home-based workers by the year 2010. If that is the case, then impacts could well be profound on traffic, County revenues, and land use patterns. One purpose

of comprehensive plan review is to identify trends, evaluate their potential significance, and prepare guidelines for channeling their impacts. Growing significance of HBW is certainly one of those trends.

Although plenty of evidence indicates HBW is extensive today, the County, unfortunately, lacks information to help gauge its scale or to take it into account in formulating planning policies. We do not know how many incidences there are in the County of each variety, or where and what role they play in the County's economic base. We do not know the extent to which County employers are supporting telecommuters who live outside Montgomery County. We do not know travel patterns, purchasing patterns, overhead costs borne by the home-worker household or the employer, or the economic value of County services rendered to HBWs. Nor do we have a basis for estimating the costs and benefits relative to other alternatives.

In our information-centered society, much of this is knowledge the County can readily obtain. Fortuitously, it is just at this time that the County's Office of Management and Budget is preparing the questions for its 1989 County resident sample survey. Including some HBW questions in the questionnaire could provide some answers fairly soon and would be a good place to start.

Beyond this, if getting a handle on the subject really merits priority, Montgomery County is one jurisdiction that has no dearth of experts able to design and execute a proper pilot study along the lines of the California

work. Such a study could fit well in context of either the M-NCPPC work on calibrating the new EMME 2 traffic model or the County DOT transportation demand management program.

Chapter 6

Tiltrotor Aircraft and Montgomery County

[REDACTED]

[REDACTED]

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TILTROTOR AIRCRAFT AND MONTGOMERY COUNTY

Primary Sources

Federal Aviation Administration, *White Paper Civil Tiltrotor* — The Technology Emerges, 1988

Aviation Week & Space Technology, "Success of Tilt-Rotor Service Will Require Special Heliports," November 9, 1987

Metropolitan Washington Council of Governments, *Element III, Special Studies. Task: Vertiport/Helistop Feasibility Study*, 1988

Introduction

What looks like an airplane, sounds like a power lawnmower, rises straight in the air, carries as many passengers as a bus and can deliver a Bethesda businessman to Wall Street in one hour? The answer is an FAA certified tiltrotor aircraft, modeled on the V-22, or "Osprey," a military vehicle that will begin service in 1992.

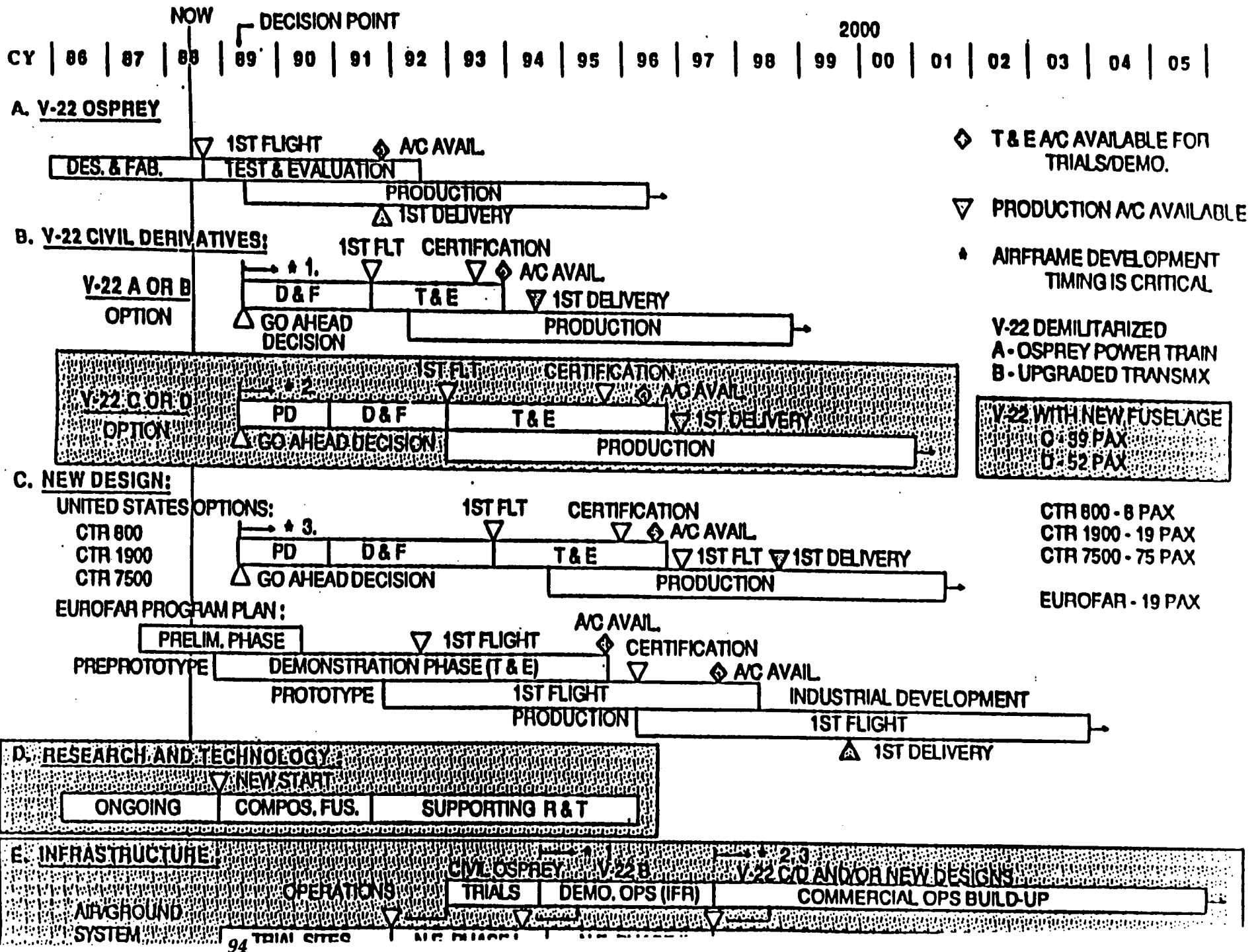
Civilian adaptation of tiltrotor technology is being pressed into production by a combined effort of the FAA, NASA, the Department of Defense, and a commercial joint-venture of Boeing and Bell-Textron. According to the timetable (attached), American-built, civilian tiltrotor aircraft will be ready for passenger service within the first decade of the 21st century. If they are not, it is highly likely that a consortium of

European producers, EUROFAR, will have an aircraft waiting to take its place. Unlike the battle for the SSTs during the 1960s which went to the Europeans because Congress declined to fund U.S. research and development, trans-Atlantic competition with the tiltrotor is a neck-and-neck race.

The reason is quite straightforward. Tiltrotor technology promises to alleviate one of the most serious infrastructure problems of both the United States and Western Europe: airport congestion on the ground and in the skies. The primary function of commercial tiltrotor service will be to deliver large numbers of passengers quickly and safely between metropolitan areas within a range of 300-600 miles. It will be able to do so without requiring use of major metropolitan airports (although service can be integrated there as well) and, conceivably, with flight patterns different from those of today's passenger carriers.

Given the impetus behind tiltrotor development, it seems clear that service between Metropolitan Washington and Manhattan will be flying by 2010. Recognizing that prospect, the Metropolitan Washington Council of Governments has just embarked on a major research effort to evaluate feasibility of such service, to establish criteria for sites within the region, and to examine specific site possibilities.

CIVIL TILTROTOR AIR TRANSPORTATION SYSTEM AIRFRAME AND INFRASTRUCTURE SCHEDULES



Three key questions about tiltrotor aircraft which face Montgomery County can be appropriately addressed within the comprehensive plan review. They are:

1. Is there likely to be sufficient market for inter-urban service from Montgomery County itself to warrant one or more "vertiports" within the County?
2. Are noise and related safety characteristics of the aircraft likely to afford constraints on where such a facility should be located?
3. If a market exists and the noise and safety questions can be handled, where within the County should a search for sites focus? What size, land use, and environmental requirements need to be considered?

The Technology

The concept of a flying machine that rises vertically from a small pad like a helicopter and then, when airborne, rotates its engines 90 degrees to carry on with the speed and performance of an airplane, was first realized in 1953 with the Bell XV-3. Its successor, the XV-15 research aircraft, was tested for many years by both the military and NASA, and in 1992 the V-22

Osprey will begin service for the DOD. It is designed to be used by all branches of the military.

Civilian applications are being sponsored jointly by the FAA, NASA, and DOD; and are being developed by the Bell-Boeing consortium as a derivative of the V-22.

The V-22 is an airplane that can hover or a helicopter that can fly as fast as an airplane. . . . It is a twin-engine airplane that in emergencies can utilize power produced by one engine to maintain balanced thrust from both proprotors. All of these characteristics are unique to tiltrotor aircraft.

The Osprey can travel twice as far and twice as fast as the helicopters it will replace. Following are just a few of the remarkable features and abilities that give this airplane its high productivity and even higher expectations:

Short vertical take off and landing capability

Operating speeds from zero to more than 300 knots. . .

External cargo loads up to 15,000 pounds

Advanced all-composite airframe and proprotor system

Interconnecting drive shaft for single-engine operation

CTR 800

XV-15 Size
(8 Passengers)



- New High-Wing Design

CTR 1900

New Tiltrotor
(19 Passengers)



- New Low-Wing Design

CTR22A/B

V-22 Min Change
(31 Passengers)



- Nonpressurized Fuselage

CTR 22C

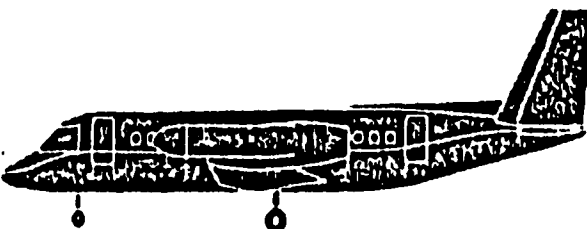
V-22 Derivative
(39 Passengers)



- New Pressurized Fuselage

CTR 7500

New Tiltrotor
(75 Passengers)



- New Low-Wing Design

Tiltrotor Configurations

Civil tiltrotor configurations developed for the study are shown to the left. One configuration, the CTR-800, is based on the XV-15 tiltrotor size. Two configurations, the CTR-22A/B and CTR 22C, are derivations of the V-22 military tiltrotor, and two configurations, the CTR-1900 and CTR-7500, are all new civil tiltrotors. An additional derivative of the military V-22 tiltrotor, the CTR-22D, was developed to evaluate higher capacity and a more efficient fuselage cross-section.

The design technology of the V-22 military tiltrotor drove the preliminary design of all the configurations. Guidelines for civil tiltrotor design were developed by NCAC, Bell, and Vertol based on V-22 and commercial design experience. Specific modifications were based on federal aviation regulations and input from commercial operators.

The structural design concept and propulsion systems used on all the configurations are the same as the V-22 military tiltrotor; these include the twin-engine arrangement, rotors, controls, gearboxes, and driveshaft cross-shafting. Some modifications were needed, depending on the location of the auxiliary power unit and whether a high or low wing was used.

Source: Boeing Commercial Airplane Co., et al
Civil Tiltrotor Missions and Applications: A Research Study
July 1987, p.11

Automatic proprotor folding and wing-stowing system

All-glass cockpit and digital fly-by-wire flight control system.¹

The same issue describes flight characteristics:

Tiltrotor aircraft have a lot going for them. The safety aspects are what I like the most. There's redundancy galore and systems that can get you out of trouble easily.

What makes a tiltrotor a tiltrotor is its unique thrust control. Believe it or not, the pilot controls thrust vector with only his left thumb. Two switches located at the top of the power lever control rotor rpm and the angle of the nacelle. With the flick of a thumb, the pilot can go from full helicopter to full turboprop in about 12 seconds. That's all there is. . .

Even though the tiltrotor has both helicopter and airplane flying qualities, its flight controls are surprisingly uncomplicated. Standard stick and rudder pedals and a collective pitch power lever are there. Flaperon, rudder and elevator, too. As you convert from helicopter to airplane mode or from airplane mode to helicopter, the helicopter control washes in or out as a function of the nacelle position.²

While the tiltrotor could be used for general aviation, almost all of the civilian-prototype R & D is going towards developing commercial scale vehicles. These will carry from 19 to 75 passengers, and drawings which show the alternative configurations are attached.

Costs

Because of the complex technology, according to Aviation Week and Space Technology (Nov. 9, 1987), production tiltrotor models will cost about 50 percent more than turboprop transports of comparable capacity.

The initial price of a 39-seat, pressurized tiltrotor transport based on the V-22 is estimated at \$18 million, including certification, based on a production run of 300 aircraft. Operating costs are also at least \$300/hr higher than those for fixed-wing aircraft.³

The relatively high cost of the vehicle, at least initially, is a factor in the industry's conclusion that it will be designed principally to service the business traveller.

1 Don Chestnut, "The Tiltrotor Arrives" in *Professional Pilot*, August 1988, p. 40

2 Dorman Cannon, "Fly It — You'll Love It," *Professional Pilot*, op. cit., p. 44

3 p. 115

Vertiports

The facilities from which the vehicles will operate are termed vertiports to distinguish them from heliports, although the tiltrotor fields can do double duty. Considerable research on the size and configuration of these facilities remains to be done, but the studies thus far indicate that they can be confined to very small (5-12 acres) sites.

The size of facilities were estimated to require approximately two acres to four acres to accommodate 60 to 200 peak hour enplaned passengers (EP), respectively. Auto parking would add approximately three to eight acres, respectively, though it should be regarded as an optional facility element in recognition of the limited space which will be available for development for such facilities in urban centers, as well as the availability of public transportation.⁴

Noise Characteristics

One of the major factors inhibiting the location of heliports in settled areas has been noise. According to the literature examined for this review, tiltrotor aircraft will be far quieter and vertiports will become acceptable neighbors for many urban uses.

...tiltrotors are good neighbors. They are surprisingly quiet. In fact, the noise level of a tiltrotor hovering at 500 ft. is no louder than that of an accelerating truck at 100 ft. distance. In the turboprop mode at 1000 ft., the noise is less than an automobile makes at 100 ft.⁵

Community noise estimates show the tiltrotor to be less noisy than either helicopters or turboprops. Noise that is produced is well within levels permitted by current federal rules. Furthermore, noise generated by a tiltrotor will tend to remain within the vertiport itself (see noise profile of 80 DBA contour—acceptable residential level).⁶

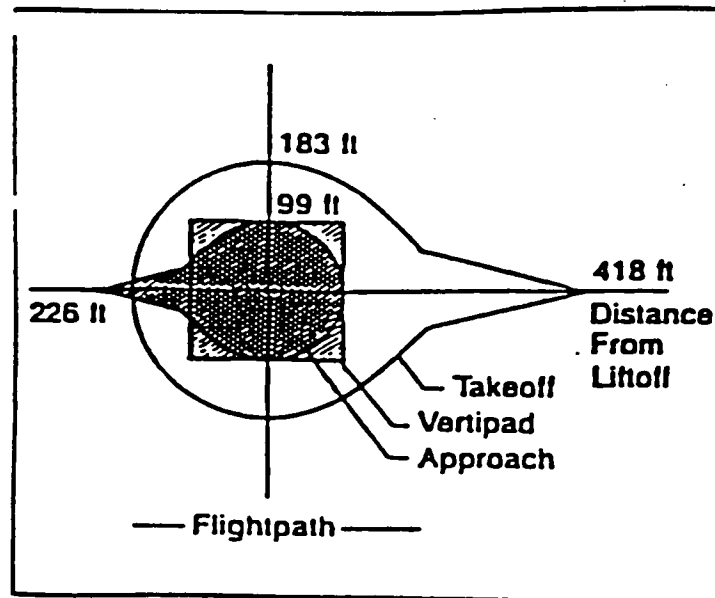
Attached is a graphic from the Boeing research which gives a more precise reading on current estimates of noise contours. It indicates that the 80 DBA level can be contained within about 2.5 acres from the center point of the vertiport. It does not indicate, however, what sound levels might be beyond that distance.

An FAA chart which appears in the Montgomery County Airports study recently submitted to County Council is also attached. This chart indicates that 80 DBA is higher than an acceptable level for adjoining residential uses, but could readily be tolerated in an area whose use pattern is predominantly commercial

4 Hoyle, Tanner & Associates, Inc. et al, *VTOL Intercity Feasibility Study for the Port Authority of NY and NJ*, 1987, p. 13

5 L. M. Horner, "Solution for Congestion" in *Professional Pilot*, op. cit., p. 38

6 Boeing Commercial Airplane Company: *Civil Tiltrotor Missions and Applications: A Research Study*, July 1987, p. 43



Noise Profile (80 dBA Contours)

Source: Boeing Commercial Airplane Co., et al
*Civil Tiltrotor Missions and Applications:
 A Research Study*
 July 1987, p. 43

LAND USE COMPATIBILITY

Land Use	Yearly Day-Night Average Sound Level (L _{dn}) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail — building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade — general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf course, riding stables and water recreation	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

* The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part. 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Key to Table

SLUCM Standard Land Use Coding Manual

Y (Yes) Land use and related structures compatible without restrictions.

N (no) Land Use and related structures are not compatible and should be prohibited.

NLR Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30 or 35 Land used and related structures generally compatible: measures to achieve NLR or 25, 30, or 35 dB must be incorporated into design and construction of structure.

Source: Federal Aviation Regulation Part 105

After: Dynaplan International Corporation

or industrial or in an area where there are other transportation facilities.

Noise suppression is one of the prime targets of the joint governmental-private sector research effort under way on tiltrotor technology. The jury is still out, but it seems highly likely that noise from the approach zones and from take-offs and landings will be at an acceptable level for most urban uses before any passenger craft are placed into service.

The Research and Development Program

The current government-sponsored program is intended to address noise and attendant flight path and safety issues on an accelerated basis. FAA Director McArtor announced that program in June 1988 and commented on the safety questions:

I am turning up the heat on FAA's research and development efforts and have allocated the R&D money earmarked for tiltrotor in this next fiscal year's budget to include some \$3 million. This R & D money will be spent on development of terminal instrument approach procedures, airborne systems, air traffic control procedures, and vertiport design. We need to start thinking creatively about precision approaches and departures for aircraft in what may be an obstacle-restricted environment. We need to be adapting collision avoidance capability, and designing obstacle avoidance technologies and cockpit

data management systems. From an air traffic standpoint, we need to ask what about separation standards for an aircraft that may be in a conversion state — from fixed-wing to rotorcraft — during final approach descent? and vertiport design — what about new technology lighting systems, maybe using lasers, requiring less acreage while still giving good approach guidance? and what about determining Optimum Locations and Environs for vertiports?⁷

As indicated on the attached schedule, research is intended to occur through the mid 1990s, along with the acquisition and testing of over 20 sites prior to inauguration of commercial service.

The Market

While the government and industry spokesmen see a broad market for tiltrotor operations — from rescue missions to package hauling by carriers such as Federal Express — their principal focus is on the business traveller, and their principal area for market testing is in the Northeast Corridor between Boston and Washington. They see the vehicle's primary potential as providing relief to the New York airports, Washington's National, and Boston's Logan, and the market segment to be that currently captured by the air-shuttles and other high passenger, short-haul service.

7 Speech to the American Helicopter Society, June 16, 1988

A major market study has been recently conducted for the New York Port Authority. That study concluded:

The domestic business traveller portion of the New York air passenger market was identified as the one most likely to benefit. . . . This is because of the time savings to the business traveller who could pay the relatively higher cost of such service...Significantly, two of the densest, domestic business travel markets are within the market area; New York- Boston and New York-Washington, D.C. . . . A fare equivalent to current air shuttle prices to New York plus the cost of ground transportation (approximately \$102) was estimated to yield a 61% penetration of the potential VTOL market.

. . . Given the assumptions which had to be made to estimate the potential market for a service which does not now exist, it is realistic to describe the potential market size as a range between approximately 5 million and 8 million passengers in the year 2000. . .

. . . Though the core city areas represent the major markets in most cases, significant market demand exists in suburban areas. The total passenger market identified assumes a service route structure which connects all the demand centers.⁸

Attached is the summary market chart of the Port Authority Study. The study goes on to identify the two priority locations in Washington area as Downtown D.C. and the Northern Virginia suburbs.

Implications for Montgomery County

Given the probability of operational tiltrotor service by the beginning of the century, the first question which needs to be addressed is whether a market for such service may exist to warrant one or more vertiports in Montgomery County, at least in the initial years. The Port Authority study suggests that Northern Virginia may have a sufficiently high level of business travel to warrant siting prior to Maryland. But some important questions need to be addressed before such a conclusion can be reached.

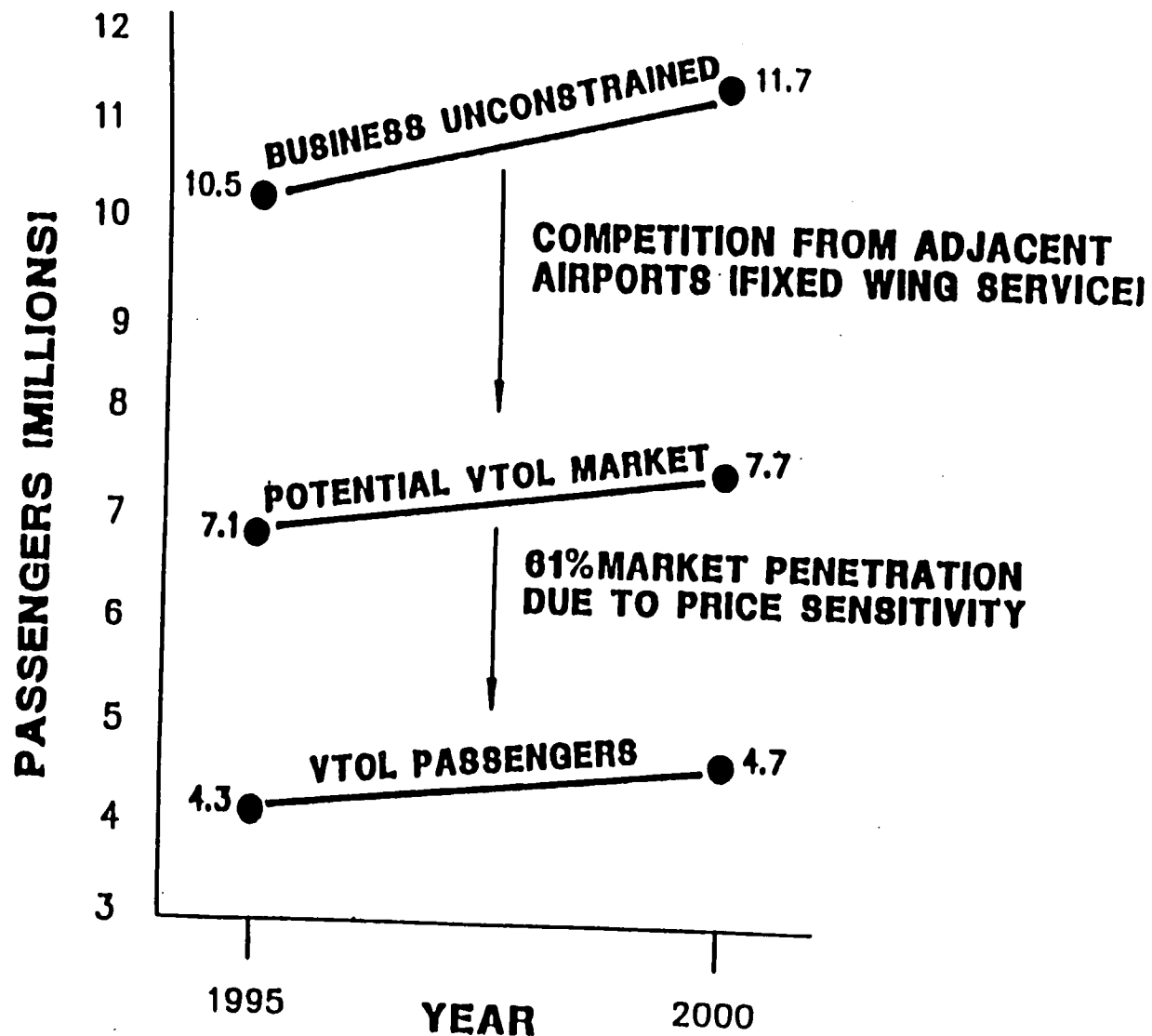
One is whether air-space restrictions might preclude location of such a facility at a downtown D.C. site accessible to the bulk of business travel, thus giving some extra advantage to a Montgomery County site. A second relates to Montgomery County's own economic growth.

Let us assume that business travel will be the core market. If Montgomery County's employment growth corresponds with the high job scenarios, could expansion at that scale — depending on the character of the jobs to be generated — provide the basis for tiltrotor travel at locations accessible to the I-270 corridor and the County's CBDs? These questions will, doubtless, be addressed in the COG study, in which Montgomery County (through the DOT) will par-

8 Op. cit., p. 7-8

FORECAST OF BUSINESS AND VTOL PASSENGERS

Source: New York-New Jersey Port Authority, op.cit.



ticipate. COG's study will forecast demand for VTOL passengers, develop site selection criteria, analyze candidate sites, and recommend potential locations.

Some clues to potential demand levels can be obtained through the periodic Washington-Baltimore Regional Air Passenger Surveys conducted by COG. The most recent tally showed that in 1987 Montgomery generated 1.6 million passengers for a total of 12 percent of the travel at the three regional airports. The number of passengers from Montgomery rose by over 600,000, or 54 percent, since the earlier 1982 survey. Montgomery's total was about two-thirds that of Fairfax County, which had grown by over 80 percent in five years. These were, by far, the two largest suburban generators. The two together practically equalled the volume of traffic generated from the District.

The COG survey is further differentiated by traffic zone. It is interesting to examine where, within Montgomery County, trips were generated in 1982 and 1987.

Attached is a table derived from the most recent COG survey which shows origination of trips by specific air traffic zone within Montgomery County. It shows that the largest proportion of trips, amounting to 39 percent, (and the greatest growth from 1982) was generated in the I-270 corridor (Rockville, Germantown, and Gaithersburg). The single largest generating area in both years, however, was Bethesda, 32 percent.

The COG study also provides origin data for sections of the District of Columbia. Northwest Washington generated 611,000 passenger trips in 1987 (more than Bethesda) and might be added to any tiltrotor market generated from Montgomery County if a vertiport site were accessible to it.

If Park and Planning elects to pursue a more fine-grain preliminary examination of market prospects, the COG data can be disaggregated to identify specific destinations for Montgomery County passengers by air traffic zone. The survey report itself combines all such information into "Maryland Suburbs." These figures show that 27 percent of Maryland suburb passengers are bound to the Middle-Atlantic States or New England and 10 percent are destined for New York, the principal markets identified for tiltrotor service.

Locations Within the County

This scanning exercise has not permitted us to identify specific candidate sites, although it does suggest some criteria for investigation if a market can be determined. Given the present distribution of passenger origins, sites accessible to Bethesda and the I-270 corridor look to be the most promising. If such sites could be reached by roads and public transportation within one-half hour from point of origin, they would be clearly competitive with locations in Northern Virginia, Downtown Washington, National and Dulles Airports.

**Washington-Baltimore Regional
Air Passenger Survey**

Montgomery County Originating Passengers by Aviation Zone

<u>Aviation Zone</u>	<u>B.W.L.</u>		<u>National</u>		<u>Dulles</u>		<u>Total</u>	
	1982	1987	1982	1987	1982	1987	1982	1987
49 Bethesda	25	24	277	335	59	160	361	519
50 Silver Spring	16	26	101	69	21	24	138	113
57 Potomac	14	7	82	84	21	84	117	174
58 Rockville	32	32	182	181	34	133	248	355
59 Wheaton	19	29	24	53	3	31	44	112
60 NE Montgomery	10	34	9	25	7	18	26	77
68 Germantown	4	11	40	64	5	83	49	158
71 Gaithersburg	10	12	55	56	11	56	76	125
	128	185	770	867	161	589	1059	1633

Source: 1987 Washington-Baltimore Regional
Air Passenger Survey, Vol. II. Appendix A

Note: Due to rounding, the totals do not always
coincide with information in the individual
cases.

In this respect Metrorail provides special advantages. Let us assume that sites of 5-12 acres can be identified in the vicinity of the Rockville or Shady Grove Metro stations. If not immediately adjacent to the stations and accessible by foot, demand might warrant shuttle service from the station to the vertiport.

Ground travel time from Friendship Heights and Bethesda could be as little as 20 minutes by Metro. Automobile travel from employment centers north of the Metro terminus would be similar. Of considerable importance is that a Metrorail-accessible vertiport could pull from the large Northwest D.C. market as well, which would also be a half-hour or less by public transportation.

Ultimate construction of the Georgetown Branch light rail connection would also link Silver Spring into the network, another promising consideration if current plans for expanding that CBD as an employment center are realized.

Public transit access would minimize the parking requirements for vertiport service. If close to the station itself, moreover, parking for the vertiport could conceivably be combined with additional expansion parking for Metrorail.

Public transit aside, one or more vertiports near the rail corridor would benefit by direct vehicle access from the Interstate highway system and the Intercountry Connector.

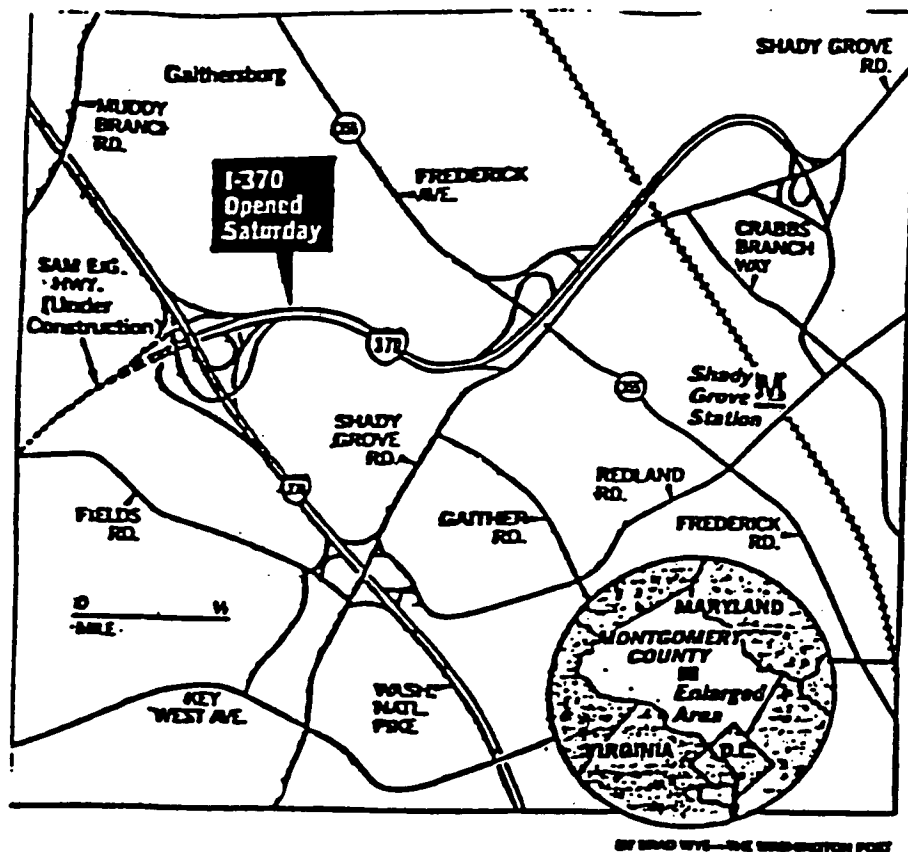
Issues of noise and safety might also support such siting. Even if the present noise research on tiltrotor technology succeeds beyond the FAA's expectations, it is unlikely that Montgomery County would wish to site a vertiport in a residential area. According to the preliminary data cited above, the present governmental, commercial, industrial, and transportation uses south of I-370 near the Shady Grove station appear to be potentially good neighbors to a vertiport. They also provide a shield from residential areas.

Attached is a map from a recent edition of The Washington Post which shows the Shady Grove station area and its related infrastructure. It is conceivable that a site search could identify contiguous parcels of 5-12 acres that are either vacant or potential candidates for conversion to vertiport use.

A Note on Heliports

A vertiport to support tiltrotor service can be sited independent of any relationship to helicopter service or needs. In the case of Montgomery County, however, there may be sufficient justification for a combined facility, particularly if candidate sites are in the Rockville-Gaithersburg area. This is because the recent County airport study identified a long-term need for a helicopter base in that general vicinity by the year 2010.

The Montgomery County forecast of 25 helicopters and 38,400 helicopter operations offers an indication that there could be sufficient demand to meet the



Source: *The Washington Post*, December 22, 1988, p. D1

based helicopter or itinerant helicopter operations criteria for establishment of a NASP helicopter landing facility. Based upon the zonal distribution of rotorcraft and using an assumption that the majority of the helicopters within the various Planning Areas might base at a location within or immediately adjacent to these demand centers, the potential need exists for helicopter basing facilities in the areas of south Montgomery County and the Gaithersburg-Rockville Area. With respect to the latter, a general aviation airport in the vicinity of Gaithersburg or Rockville would probably serve the helicopter demand in that area.⁹

Helicopters have substantially different noise and service characteristics from tiltrotor aircraft. Their accommodation would present yet another range of issues for consideration. We have clearly not investigated the matter, but believe it does merit examination as a related subject if the County explores further the feasibility and location of tiltrotor vertiports within the comprehensive plan review. For if demand for a heliport emerges before civilian tiltrotors become operational, a joint facility well-related to Metro and the expressway system could make sense, with helicopter use preceding and setting the stage for later inter-regional commercial transport.

Concluding Note

All signs point to feasibility of tiltrotor service within Metropolitan Washington by the year 2010. Whether Montgomery County should provide sites for such service and where, must depend on more refined market investigation. Fortunately, the Council of Governments has embarked on a thorough region-wide investigation of the subject. The COG study includes helicopter facilities as well as vertiports, a matter which adds weight to early and extensive County participation in the study. Montgomery County had that region-wide involvement in the initial studies of Metrorail locations and stations. It benefitted greatly by being able to anticipate opportunity, clarify and express its interests, and understand potential impacts. The parallels are strong.

9 Dynaplan International Corporation, *Working Paper Montgomery County General Aviation System Plan*, 1988, pp. 91-92

Chapter 7

Economic Recession and Montgomery County

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ECONOMIC RECESSION AND MONTGOMERY COUNTY

Primary Sources

Cetron, Marvin and Owen Davies, *The Great Job Shake-Out*, Simon and Schuster, New York, 1988

Montgomery County Council Economic and Budget Strategy Committee, *Impact of the Federal Gramm-Rudman-Hollings Legislation on Montgomery County*, April 1986

Sawhill, Isabel V., Ed., *Challenge to Leadership*, The Urban Institute Press, Washington, D.C., 1988

U.S. Department of Commerce, *Industrial Outlook 1989*, Excerpt, pp. 4-23

Introduction

Between the optimistic picture painted by the U.S. Department of Commerce' recent issue of Industrial Outlook and the dire threat of a great crash and global depression heralded on the covers at popular bookstands, lie the opinions of thoughtful economists that prospects for the American economy — while less than rosy — are not yet altogether irretrievable.

Whether they regard Cetron's one in ten odds of a severe recession within three to five years (and one in

twenty of an outright depression)¹ as correct or not, there is general agreement we are in for some hard times at least through the early 1990s. After that, however, new technologies are expected to lead a strong expansionary trend that will carry well into the next century.

Our multi-trillion dollar national debt and a budget deficit around the \$160 billion² mark this coming year head the list of serious issues. The litany includes the tremendous backlog of consumer debt, drying up of private savings, persistent unfavorable balances on the international trade ledger, and an economy undergoing the dislocations of a major post-industrial overhaul. Continuing productivity problems in manufacturing and declining employment in traditionally strong sectors signal that restructuring still has quite a way to go before the transition is complete.

Dealing with the federal deficit is widely thought to be absolutely imperative. Failure to do so puts the United States at risk of being unable to deal with other pressing domestic and international problems that — if they are not yet on the scene — could well appear.

1 Cetron, op. cit., p. 20

2 The actual deficit will be over \$200 billion. The \$160 billion figure from the President's budget assumes about \$50 billion from the Social Security Trust Fund surplus will be used to reduce the deficit.

Kinder, gentler approaches to budget reduction such as selling off government assets helped in late 1987 when we were under the Gramm-Rudman gun, but are not going to be enough. Many feel we simply cannot afford to wait as long as it will take for the economy to grow itself out of trouble. Notwithstanding the fact that the economy does show signs of health and the impetus for moderate expansion seems to have some oomph left, speedier deficit relief is going to call for tougher measures. The positive forces currently in evidence may, however, help the bitter medicine go down.

James Minarik and Rudolph Penner, writing for The Urban Institute, characterize the situation in the following manner.

The federal budget is like a debilitating disease. It has weakened government's ability to undertake important initiatives, and it has inspired increased dishonesty in the budget process as policymakers resort to accounting tricks and off-budget initiatives to minimize the problem artificially. The inability to deal effectively with the deficit has shaken the confidence of Americans and foreign observers in the ability of the United States to manage its own affairs.

If left untreated, the deficit disease could become very painful. Thus far the pain has been mitigated by the willingness of international lenders to supply the United States with relatively low-cost credit to finance both a private spending binge and public dis-

saving. But in 1987 international investors became disenchanted with U.S. policy and demanded higher risk premiums for a smaller supply of funds. If this disenchantment grows into a capital flight from the United States, the shock to the U.S. economy could be severe indeed.

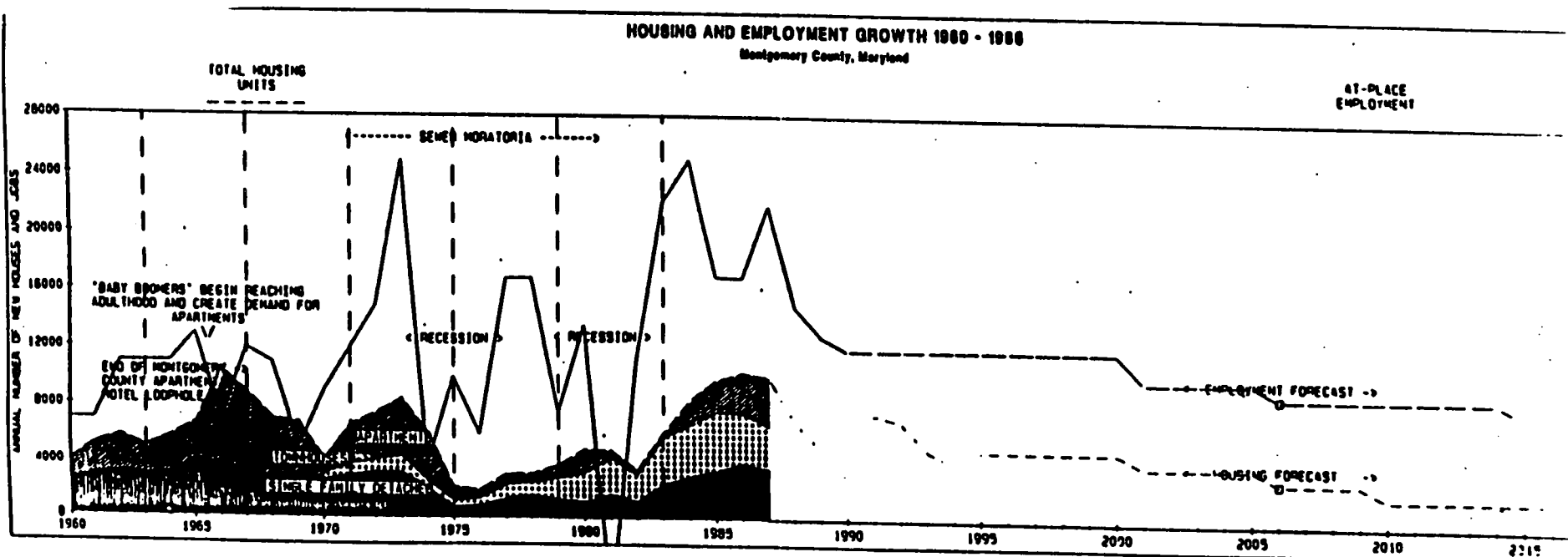
The problem is that the cure for the disease is also painful. Policymakers have already accepted considerable pain to contain deficit growth. Taxes have been raised significantly and nondefense spending has been constrained since 1981. But these actions, however courageous, were not sufficient to put the deficit on a rapid enough downward path, and there is much more to be done.³

... On the surface, the political impasse appears to be between the president and the Congress, but that impasse has its roots in the ambivalent and somewhat inconsistent desires of the American electorate. There are clear signs that the political pendulum is beginning a slow leftward shift and the American people, although still quite conservative, are again beginning to demand a more activist government on domestic issues . . . Public opinion polls show growing support for initiatives [in expanding Medicare] . . . as well as for increased spending on education . . . At the state and local levels, which provided the first signs of the swing to the right with the tax revolts of the late 1970s, spending has been rising, and state and local tax burdens relative to GNP are back up to where they were before the tax revolts lowered them — and they will probably surpass those levels this year.⁴

3 Sawhill, *op. cit.*, p. 279

4 Sawhill, *op. cit.*, pp. 28607

Source: "Envisioning Our Future", The Report of the Commission on the Future of Montgomery County, Maryland, June 1988, p.144. Prepared by the Research staff of the Montgomery Planning Board and Commissioner William Hussmann for the Commission on the Future.



In their best-case scenario, Minarik and Penner envision the federal government pursuing combined spending and taxation strategies sufficiently firm to bring the deficit down, thus reassuring investors and creditors, but staged-out over a five-year period so as not to thwart economic growth altogether. Spreading the impact this way, they say, would help minimize the pain, maintain some degree of stability and avoid disrupting the long-term sources of recovery and expansion. Given a chance to take hold, economic expansion itself can finish the job of clearing up the remaining deficit.

They acknowledge realistically the enormous political obstacles to such a discipline, pointing out nonetheless, the specter of impending crisis that hovers over the alternative: too little action – too late followed by too much – too suddenly. In Cetron's "worst of all possible worlds" scenario, inaction or inappropriate action will trigger panic and global chaos at a scale so massive that he borrows the term "core meltdown" from the lexicon of nuclear catastrophe to describe it.

Implications for Montgomery County

The foregoing suggests that impacts associated with one or another of the possible scenarios are likely to differ in more than degree. Nevertheless, for the purpose of this exercise, we shall assume that the national economy will sustain an economic downturn sometime in the 1990s and that its effects on Montgomery County will be more or less similar in nature, though

possibly somewhat greater in degree and duration than other cyclical swings experienced since the 1960s.

Past Experience: Fluctuations Around an Underlying Growth Trend

Conventional wisdom has long held that Montgomery County, as an integral part of the national capital region, is "recession-proof." Historically, the effects of major cyclical swings in the national economy have been cushioned by the central role of federal government here. As the fluctuations charted in Figure 1 indicate, however, Montgomery County is not immune from the effects of major changes in the federal government. Indeed, the linkage is so intimate as to heighten the immediacy and intensity of the impact of federal actions.

Figure 1 charts the number of "at-place" jobs added in Montgomery County each year between 1960 and 1985. Annual housing completions, broken down by housing type, are plotted on the same scale. The series of peaks and valleys revolves about a strong underlying upward trend. The timing of the shifts is significant in its relationship to developments in federal policy.

Steady growth in the County through the New Frontier and War on Poverty years paralleled the expansion of federal functions and personnel. Construction dipped when interest rates rose in 1966 and in the late 1960s period of civil unrest. Another dip reflected the

slowdown when EPA's ban on sending more sewage to the Blue Plains treatment plant resulted in a construction moratorium. Then there were the recessionary/inflationary period of the middle-to-late 1970s with whopping escalation of nominal interest rates and major reductions-in-force through civilian federal agencies. The most recent downturn coincided with the national recession and additional reductions in federal employment of the early Reagan administration. This last cycle has shown the deepest drop yet followed by the steepest recovery peak.

Each time, the impacts on employment have led the impacts on housing. Gains in the recovery periods seem to be much slower for housing than for employment. The post-1972 expansion in employment was comprised in large measure of a backlog of pent-up demand that had built up during the sewer moratorium. The massive post-recession growth of the 80s was fueled by a massive increase in federal spending, much of it for purchase of contract services from the private sector. Rates of growth for the projection period beyond 1987 indicate the expectation of County planners that a turning point has been passed so far

as the pace of development is concerned. This reflects what, generally, is anticipated for the metropolitan area.

The Longer-Term Background Trend

Philip Dearborn, Vice President of the Greater Washington Research Center, pointed out in briefing Montgomery County's Commission on the Future, that our regional economy is tending increasingly to show cyclical patterns parallel to nationwide business cycles. He predicted that the regional economy will experience some dampening of its high growth pattern. He cited two basic reasons. One is the expectation of federal spending, which may be the basis for half the personal income of this area, moving into a retrenchment mode. The second is a series of "supply side" problems, i.e., inability of the area's labor force, housing supply and transportation facilities to accommodate sustained growth on the order of 100,000 new jobs annually. He forecast for the years through 1995 a 40 percent drop in the rate of new job creation, areawide,⁵ to a pace on the order of 60,000 jobs a year.

5 The Metropolitan Washington Council of Governments' Round IV projections show similar rates of increase for their intermediate growth scenario. Underlying assumptions include: a sustained period of 2.3% annual GNP growth, productivity increases of 1.2%, an unemployment rate of 6.0% and an expansion of the civilian labor force of 1.2%. Expansion characteristic of that which occurred in the 1950s and 60s would prevail, with an influx of younger, well-educated middle-level technicians and policymakers and their young families. Private sector information-processing industries would grow at rates exceeding those elsewhere in the U.S. Under this scenario, the pace of employment growth would drop to 45,000 annually in the years immediately following the turn of the century. A low-growth scenario, which would generate only 1/3 to 1/2 as much employment as the intermediate projection, includes such features as grassroots pressure on Congress to spur job growth in home districts, requiring decentralization of federal employees (mostly lower-

In *MarketTrends*,⁶ the Research Center newsletter, George Grier, analyzed the prospects as follows:

... the Washington area's dramatic job growth in the mid-80s, which was fueled by federal spending, could lose some of its steam. On the other hand, despite the national retrenchment, federal spending here maintained an increase rate of five percent and continued to add over \$1.5 billion in new spending to the local economy last year [1987]. And this pattern could continue.

Payrolls (still the largest component of federal spending in the area) and retirement and disability payments together represent 57 percent of all spending. They are a fairly stable component of federal spending, and they have historically represented the backbone of the Washington area economy. These types of spending have grown relatively slowly, but steadily, and are likely to continue doing so. . .

The most volatile component of federal spending, both from year to year and between jurisdictions, is federal purchasing. This spending influences the location and the expansion or contraction of private businesses, and it has an indirect effect on spending for office space, entertainment, and other business expenses.

Over the period 1983 to 1986, federal purchases from District vendors more than doubled from \$1.3 billion to \$2.8 billion. The second highest growth occurred in Fairfax County, which increased from \$1.1 billion to \$2.3 billion. [An accompanying chart shows federal purchases in Montgomery County went down \$26 million between 1986 and 1987, a drop of 1.1%.]

... Perhaps the most that can be said about federal purchases is that they are unpredictable. While these purchases have been very beneficial economically to the Washington area in recent years, the potential for declines in future years makes them an uncertain factor in the area's economic future.

If we take these assessments as reliable depictions of the basic, longer-term trend, an economic recession of the 1990s would occur in context of a region still growing, but at gradually decreasing rates. We may see deeper dips, but the recovery peaks are likely to be less steep than those of the past two decades.

Marvin Cetron classifies Metropolitan Washington as one of the areas in the nation best able to withstand the impacts of a recession. The enduring qualities of federal government and the large urban/suburban service economy that supports government operations

level and routing administrative positions) to other parts of the country and scaling back of federal investments in the Washington metropolitan area. Under this low-growth scenario, most remaining federal personnel would be performing senior level functions from downtown offices and lack of infrastructure improvements would suppress significant community development outside the Beltway. Regionwide employment gains would drop steadily from an annual average of 40,000 between now and 1995, to an annual average below 25,000 in the years, 2005-2010.

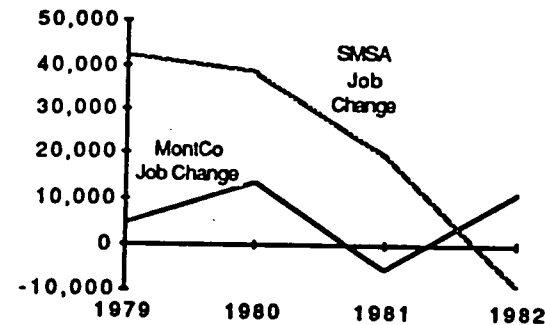
6 George Grier, "Federal Spending Continues to Fuel Economic Growth in the Washington Area in 1987," *Market Trends*, vol.3, no.12, June 1988, p. 3.

are strong, steadying influences. He believes defense cuts in the 1990s will slow the region's development, but that "economic hot spots" like the National Institutes of Health and Johns Hopkins University will attract around themselves a cluster of small high-tech biomedical research and development firms, service businesses and regional offices of national companies. He says, "Though not labor intensive, biotechnology will draw new, highly skilled workers to the area, even when other employers have slowed."

Montgomery County During the Last Recession

Let us take a closer look at what happened in Montgomery County, 1979-82, when areawide employment growth dropped from 42,000 jobs⁷ (in 1979) to 38,200 (in 1980) and then, almost 50 percent, to 19,500 (in 1981). The following year saw a net loss of 9,800 jobs in the Washington Metropolitan Area. Changes in Montgomery County employment were in those years, respectively, gains of 4,720 and 13,650 followed by a net loss of 5,800 jobs in 1981 and an increase of 11,245 during 1982. Montgomery County took the "hit" a year before the metropolitan area as a whole.

Annual Change in "At-Place" Employment



Montgomery County residents, as distinguished from employers, suffered net losses of over 7,500 jobs during 1981 and 1982.⁸

The most dramatic effects seem to have been personal and political. Montgomery County's top 4.2 percent unemployment rate was low for the recessionary period by national standards. But of the 13,000 unemployed here,⁹ over 60 percent were well educated, middle-class — even high tech — people. This component in the unemployment rolls was unprecedented since the Great Depression. The County's real per-

7 U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, January 1980. Washington SMSA Employment data for 1979 (1,521 million) are as of third quarter, ending October. Figure for 1980 (1,521 million) is attributed to the Bureau of Labor Statistics by the *State and Metropolitan Area Data Book*, 1982.

8 Montgomery County Department of Finance, *Revenue Comparison with FY'86 and FY'87 Estimates*, November 1987. Total actual personal income, however, continued to rise through the period because the county's population continued to grow. County income tax revenues continued to rise, though the annual rate of increase slowed slightly, from 12.28% between calendar years 1978-79 to 11.22%, 1989-81 and 8.91% 1981-82. by the next year, income tax revenues were up again by 11.4%.

9 Montgomery County Government, *Report of the Task Force to Study the Needs of the Newly Unemployed*, May 1983.

Personal Income in Montgomery County

FY	Actual Personal Income Billion	Real Personal Income Per Capita	Real Personal Income Per Household
78	\$ 4.992	\$ 16,677	\$ 48,579
79	5.358	16,746	47,942
80	5.978	16,746	46,801
81	6.648	16,506	45,395
82	7.352	16,778	45,390
83	7.992	17,201	46,002
84	8.789	17,355	46,535
85	9.770	18,041	48,027
86	10.627	18,236	47,829
87 Est	11.936	19,370	50,540
88 Est	13.350	20,293	52,296
89 Est	14.675	20,905	53,755
FY 78-83	60.1%	3.1%	-5.3%
Annual	9.9%	0.6%	-1.1%
FY 84-89	67.0%	20.5%	15.5%
Annual	10.8%	3.8%	2.9%

sonal income per household, which had been dropping due to inflation, seemed to bottom out in 1982 before starting to rise again.¹⁰

Feeling financially pressed themselves, citizens relayed their conservative mood to County officials. County government got the message, underwent belt tightening and deferred programmed capital projects. From 1978, the year of "TRIM" (the local citizens' tax revolt movement), when 65 percent of the expenditures approved under the capital improvements program were actually made, the implementation rate dropped to 43 percent in 1979. By FY 1981, the im-

plementation rate was back up to 65 percent. It fell steadily, then to levels of 42-44 percent in FYs 1983 and 1984, and did not approach the pre-TRIM rate until 1985.¹¹

School construction priorities, in contrast with capital works in general, were not affected in this manner. Money was found to implement the school construction program — at levels ranging from 146 percent of approved CIP funding in FY 1980 to 106 percent in FY 1981, 90 percent in FY 1982, 116 percent in FY 1983 and 87 percent in FY 1984.

CIP* Implementation

FY	Approved CIP Project Spending (\$million)	Actual Project Spending (\$million)	% Implemented
78	46.0	29.9	65
79	76.5	32.8	43
80	77.3	44.3	57
81	109.3	70.8	65
82	69.1	36.4	53
83	78.1	34.6	44
84	94.3	39.4	42
85	105.6	67.0	64

*Executive Branch projects only. Parks and schools are excluded.

MCPS Capital Project Implementation

FY	Approved MCPS Capital Spending (\$million)	Actual Schools Capital Spending (\$million)	% Implemented
80	8.5	11.8	146
81	11.6	12.3	106
82	13.0	11.7	90
83	14.7	17.1	116
84	14.7	12.8	87

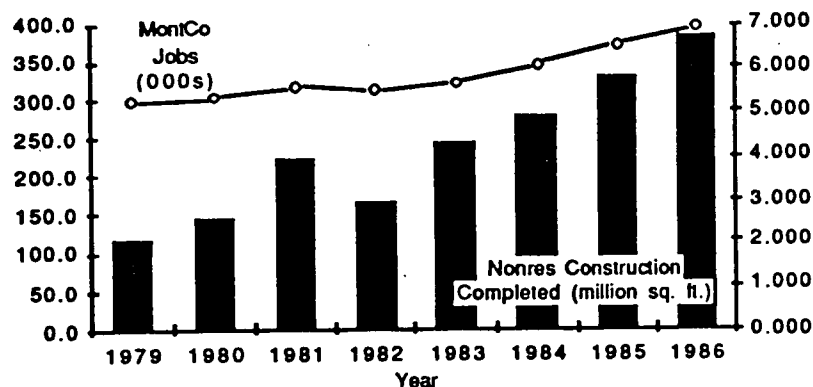
10 Arthur Spengler, Montgomery County Council Staff Director, CHS1: Trends, July 12, 1988. —Real per household income dropped from \$48,579 in 1978 to \$46,801 in 1980, and \$45,390 in 1982. It was back up to \$46,000 the following year and has been rising ever since.

11 Peter Hutchinson, Montgomery County Office of Management and Budget, Personal telephone communication, January 10, 1989. These rates are for executive branch capital projects only. Excluded are expenditures for parks and schools. School construction rates actually

Nonresidential construction, which rose from a volume of 2.1 million sq. ft. completed in 1979 to more than 3.9 million sq. ft. in 1981, dropped to a level of 2.9 million sq. ft. in 1982, but then recovered the following year, with completion of almost 4.3 million sq. ft.¹²

The County's real and personal property tax base expanded continuously. The combined contributions of new commercial, industrial and residential construc-

Montgomery County "At-Place" Employment and Nonresidential Construction Trends



tion have played a smaller role in the annual increments, however, than have reassessments. From annual additions on the order of 3.4-3.5 percent of the tax base in FYs 1978-80 and 1980-81, gains derived from new construction dropped to the 2.5-2.6 percent range each year between FYs 1981 and 1983.¹³

Tax base contributions of new nonresidential construction alone dropped from about 1 percent of the assessable base annually, pre-recession, to the .6-.7 percent range during FYs 1981-83. Afterward, it rose to a little over 2 percent in banner year FY 85-86, but has been dropping since then. This year's estimates (FY 1988-89) show new nonresidential construction is expected to be responsible for expanding the County's real estate tax base by .8 percent.

The full revenue impact of new commercial construction is not felt immediately on its completion. As buildings become occupied, their increased values are phased in to the tax rolls and show up in the "reassessments" tallies. Effects of the increased employment housed in the commercial and industrial buildings show up in other indicators of local economic activity and, of course — for those employees who are Mont-

12 Montgomery County Planning Department, Maryland-National Capital Park and Planning Commission, *Trends & Forecasts: Jobs, Housing, Population & Births*, December 1987, p. 3.

13 Montgomery County Department of Finance, op. cit., Table 1, p. 8 and *Revenue Comparison with FY '87 and FY '88 Estimates*, November 1988, p. 8. Last year new nonresidential construction added a little over 1 percent to the tax base and estimates for this current fiscal year show a drop in absolute value as well as percentage added to the tax base. The value of residential construction has exceeded nonresidential in all years.

Impact of New Construction on Real Property Tax Base

FY	Incr. in Real Property Base Due to New Construction		Residential Construction		Commercial and Industrial Construction		
	(\$million)	% Added	(\$million)	% of constr	(\$million)	% of constr	% Added to Real Property Base
1979-80	236.8	3.4	163.0	69	72.0	30	1.0
1980-81	261.9	3.5	186.0	71	73.9	28	1.0
1981-82	206.3	2.5	146.9	71	58.9	29	0.7
1982-83	240.8	2.6	186.1	77	54.5	23	0.6
1983-84	330.2	3.3	271.0	82	59.0	18	0.6
1984-85	588.8	5.2	408.1	69	177.6	30	1.6
1985-86	660.1	5.3	373.8	57	274.0	41	2.2
1986-87	666.4	4.8	458.0	69	196.7	30	1.4
1987-88	650.7	4.2	479.2	74	164.4	25	1.1
1988-89 Est	585.2	3.4	447.3	76	132.1	23	0.8

gomery County residents — in the County's income tax revenues. To understand this in context, it should be recognized that Montgomery County currently (FY 88-89) derives 43.8 percent of its revenues from real and personal property taxes. The County's 50 percent of state tax liability (the "piggyback" income tax) is the County's second largest tax revenue source, contributing 32 percent of the General Fund revenues and 24 percent of the revenues to fund the total County operating budget.¹⁴

As the following chart indicates, the net taxable income of County residents continued to rise even through the recessionary period of the early 1980s. The dip in employment — or viewed in another perspective, the rise in unemployment during those years — was relatively small. Despite the dip in real (i.e., adjusted for the effects of inflation) per household income, total personal income in the County rose because of growth in the number of households.

Although the recession caused no reduction in the County's income tax revenues, it did slow the rate of increase. Year to year percentage changes in the income tax base (i.e., net taxable income reported on the returns of County residents) do reflect the impact of the economic downturn.

¹⁴ Montgomery County Department of Finance, *Revenue Comparison With FY'87 and FY'88 Estimates*, November 1988

Montgomery County Employment and Income Tax Base

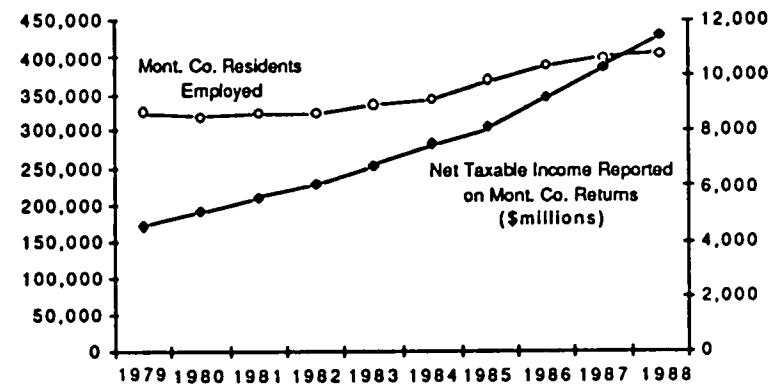
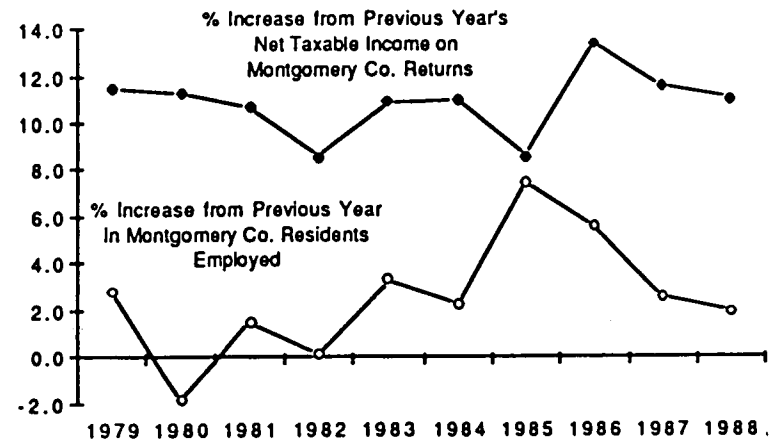


Figure for 1988 is estimated.

Year to Year Changes in Employment and Net Taxable Income of Montgomery County Residents



Federal program grants, whether made directly to the County or through the state, play a small role in the County's finances. In FY 1988, state and federal program grants contributed \$11.2 million or 1.3 percent of the County's General Fund revenues. Other federal aid amounted to \$3.4 million, including mass transit subsidies of \$2.6 million which were paid directly to the Washington Metropolitan Area Transit Authority.

Federal purchases in Montgomery County, on the other hand, are quite substantial. After growing for a number of years, however, they have started to drop. Between 1983 and 1986, federal purchases in Montgomery County rose by \$236 million, not quite 3 percent of the total increase in purchases in all Washington area jurisdictions. The following chart, prepared by the Greater Washington Research Center, shows the figures for Montgomery County in comparison with other metropolitan area jurisdictions. In 1987, Montgomery County vendors and contractors' business with the federal government was actually down \$26 million (about 1.1 percent) from the previous year.¹⁵

The following chart appeared in the 1986 report of the task force created by the County to analyze the impacts of impending federal deficit-reduction legislation. The task force pointed out that new contract growth was averaging 10 percent a year, FY 1980-85,

and that a leveling off might be anticipated as a result of the Gramm-Rudman-Hollings budget constraints. Since less than half of the \$1.8 billion in contract procurement dollars passing to Montgomery County firms actually went for labor and services within the County, they estimated that the annual economic growth in Montgomery County might be slowed down by an a maximum of 2 percentage points, which they considered within the estimating error for projections of this nature. Distribution of the largest FY 1985 contracts in Montgomery County, by departmental or agency source is shown below.

In terms of personal income, the task force estimated that a leveling off of procurement contracts might reduce the annual increments of growth by \$90 million — 6/10ths of a percent of the \$15 billion total personal income of County residents.

It has been almost four years since the Montgomery County Council Economic and Budget Strategy Committee made their study. Their analysis of impacts on County budget and direct recipients of federal funds are, by now, outdated, but the opinion they expressed about private sector impacts may still be valid. Because of the diversity within Montgomery County's economic base, they believed the County stood to be far less affected by reductions in federal employment

15 Greater Washington Research Center, *MarketTrends*, Volume 3, Number 12, June 1988, p. 5

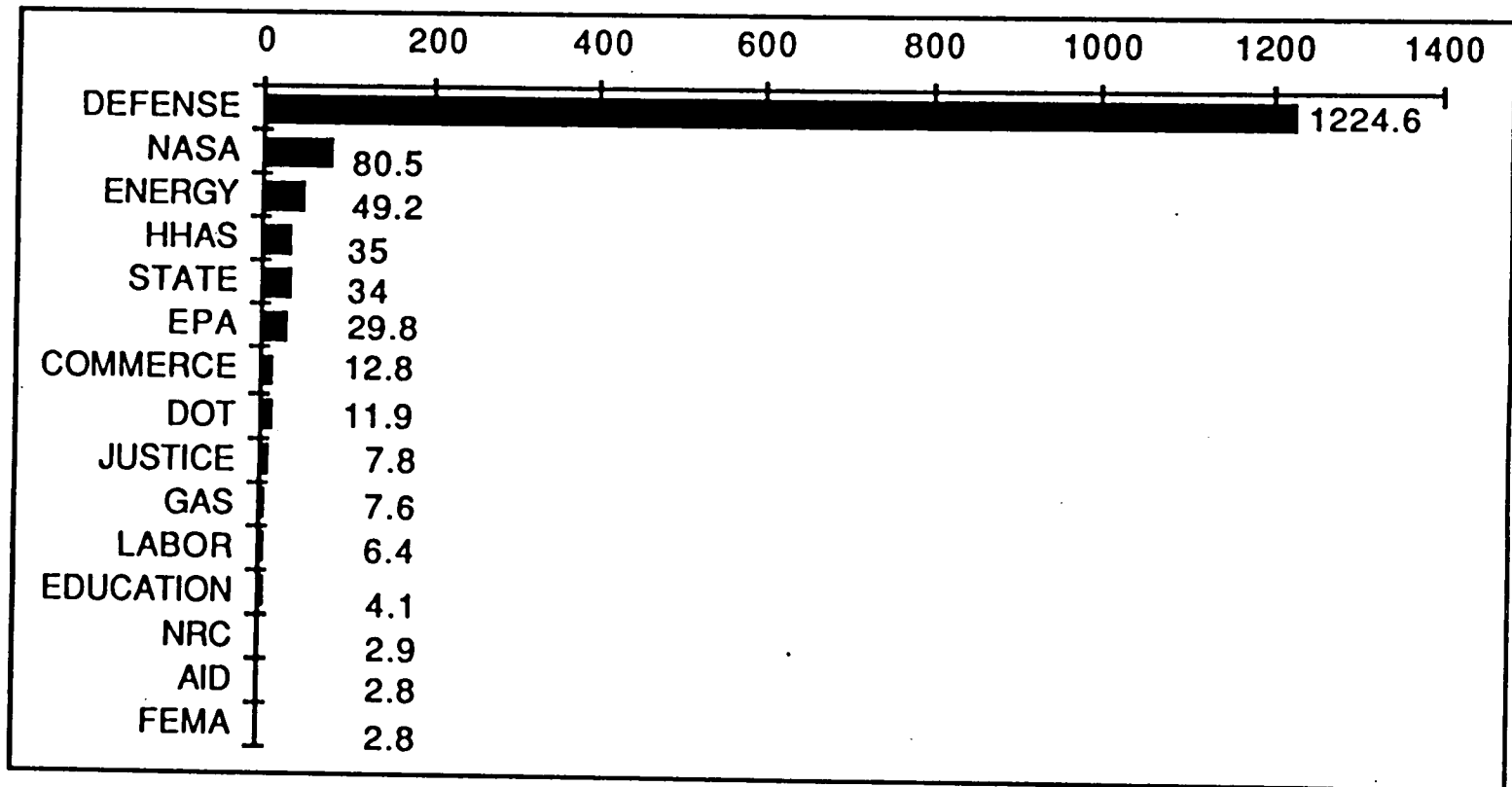
Changes in Federal Purchases *Washington Area Jurisdictions*
In Millions

Jurisdiction	1983-1987 Change		1986-1987 Change	
	Dollars	Percent	Dollars	Percent
District of Columbia	\$13,447	100.7%	-\$ 74	-2.7%
Charles County	- 4	-35.6	- 1	-15.6
Montgomery County	232	11.4	- 26	-1.1
Prince George's County	495	59.6	236	21.7
Alexandria City	327	152.0	114	26.6
Arlington County	4	0.5	1	0.1
Fairfax City	104	272.6	38	36.5
Fairfax County	985	90.4	-235	-10.2
Falls Church City	- 19	-7.2	10	4.1
Loudoun County	80	391.2	- 1	-1.3
Manassas City	772	255	632	142.8
Manassas Park City	1		- 1	-66.7
Prince William County	56	200.4	19	29.7
	\$4,380	62.8%	\$712	6.7%

Source: Greater Washington Research Center, MarketTrends, Vol 3, Number 12, June 1988.
Based on U.S. Census Data

TOTAL FY 1985 CONTRACTS (IN EXCESS OF \$2.6 MILLION)

Dollars in millions -- Total : \$ 1,512.2



and government contracts than by changes in general economic conditions. They wrote:

In the long run, it is possible that the sizable reductions in the budget deficit anticipated to result from implementation of the Act may benefit the private sector as interest rates are reduced and American industry becomes more competitive in world markets. However, there is a risk that in the short run the Act's massive shift toward budget restraint will precipitate a slowing of the current economic expansion.

... We believe that the major impact... will be a leveling out of new contract growth, which has averaged approximately 10 percent during the first half of this decade... Should the volume of procurement contracts remain level in future years, the loss in the annual growth of personal income within the County will be [less than] 1 percent of the \$15 billion in personal income in the County... The net impact of the Act on the economy of Montgomery County, and thus on local tax receipts, will be small. The Act may result in some diminution in the growth rate of the County economy, but the potential impact appears to be less than that likely to be exerted by unrelated local constraints on growth.¹⁶

Although major cuts in defense spending did not occur during the recession of the early 1980s or since, and did not figure significantly in the task force's analysis back in 1986, such cuts may well be on the horizon in the 1990s. We cannot tell at this point

whether, or to what extent, Montgomery County's defense contracting activities are likely candidates for paring. Procurements from County firms on the order of \$1.2 billion (even if only half is spent in the County for labor and services) do play a substantial role in the County's business activity. Unfortunately the task force report did not trace the channels through which such expenditures affect other sectors of the local economy. Nor did it assess the magnitude of secondary and tertiary rounds of goods and services purchases generated here by primary federal contracts. It can be expected, however, that major reductions in federal contracting could have a significant ripple effect throughout the regional economy.

Still, Montgomery County is less heavily dependent on defense-related activities than other parts of the metropolitan area such as Northern Virginia. A more diverse economic base will enable Montgomery to absorb some losses in defense work, should they come to pass. Moreover, ongoing contracts are much less likely to be affected than future business.

Office Market Implications

Massive exodus of current tenants does not appear to be an imminent threat. There has, however, already been some slowing in the rate of construction. Pockets of higher commercial space vacancy notwithstanding,

16 Council Economic and Budget Strategy Committee, *Impact of the Federal Gramm-Rudman-Hollings Legislation on Montgomery County*, April 1986, pp. 65-71

the County's overall vacancy rates (at 10-15 percent depending on the source of the estimate) are not so high as to pose a serious problem even if the office space absorption rate slows somewhat over the next few years.¹⁷

The bidding environment for federal contract work will grow more competitive, consequently increasing the pressure on federal contractors to contain overhead costs. This could well lead some to seek reduced rents for office space in more outlying locations beyond Montgomery County. But two major considerations could well temper such a movement. One is the trade-off between rent levels and accessibility to client federal agencies. The other is the pressure on landlords to cut deals enabling them to retain tenants when the market is down. The Tax Reform Act has done away with rewards for holding "see-through" office buildings. Firms occupying facilities they own are hardly likely to consider major expansion if business is uncertain and, in any event, will be faced with weighing the costs of new construction and relocation against the market for space they would be leaving.

We could envision a certain amount of musical chairs occurring as newer space coming on line leases to

tenants now located in other, older buildings in Montgomery County or the District of Columbia.

The federal government itself might increasingly be among these tenants, as pressure of rising rents downtown and budget constraints turns agencies and the GSA to look for more favorable rates in the suburbs. Those parts of Montgomery County which enjoy superb transit accessibility should be in a very desirable position to attract these federal tenants. Consolidation of two agencies (NRC in North Bethesda and NOAA in Silver Spring) has increased their respective personnel working in the County.

Other agencies could well follow suit, as Sen. Mikulski's recent announcement about a search in the County for new National Academy of Sciences headquarters suggests. If, in an effort to improve air quality or reduce the "greenhouse effect" by reducing total vehicle travel miles, the federal government undertakes a move to decentralize within the national capital region, it could well focus on the inner ring of suburbs midway between federal headquarters and the outer suburbs.

17 Duc Duong, Montgomery County Office of Economic Development, Personal Telephone Communication, January 11, 1989. Based on a late third quarter survey, this estimate is about two-thirds the vacancy rate reported by Spaulding and Slye in early December 1988. Mr. Duong explains the discrepancy as a function of the County's counting available space on the market against a total inventory of 31-32 million sq. ft. which includes all classes of space, whereas Spaulding and Slye's base includes space in large Class A buildings only.

Under such a scenario, Montgomery County would be a prime location candidate because of its high degree of transit accessibility and service. Similar considerations would pertain if the federal government were seeking to establish a series of "satellite telecommunications centers." (A companion paper in the series for the M-NCPPC seminar treats the subject of potential federal interest in substituting telecommunications for at least some portion of work-trip commuting.) One could well envision refurbishing older space near to several of Montgomery County Metro stations for such use.

Moreover, if Congress acts to redefine the "federal district" for purposes of widening location options, the constellation of activities now focused entirely on the District of Columbia could be affected. One example might be the nondiplomatic representational activities of foreign missions and international agencies. Lack of sites in the District and citizen opposition to expansion of existing facilities in historic buildings and areas could well trigger a wider search for appropriate quarters. Excellent transport links to Metro, Union Station, airports, downtown and Capitol Hill, not to mention important federal agencies and private sector trading partners here, makes a number of Montgomery County locations particularly attractive.

To summarize, it appears that losses of employment in some sectors could be made up, at least in part, by gains elsewhere. If the recession of the early 1980s serves as a guide, it appears that even net losses in

employment and vacancies in some parts of the County will not necessarily curtail new office construction altogether. New growth around the biotech complex in the northern part of the County might be slower than the most optimistic projections, but it is unlikely to be interrupted. Even if the volume of new office space construction falls off two-thirds from its recent high of 6 million sq. ft. in 1986, it will still be not much less than the County had ten years ago.

The County's adequate public facilities ordinance and annual growth policies have been a constraining influence on office and commercial vacancy rates. Construction in the County has not gotten way out ahead of the market. Projects now on the drawing boards are aimed for the mid-1990s at the earliest and some are very long term undertakings, extending a great deal farther into the future. Developers are not likely to turn a blind eye to market trends in deciding when to proceed with these undertakings.

Impacts on Housing and Revenue

Backlog of unmet need for housing across the whole price spectrum, but especially for "affordable" housing, is likely to continue to press, unabated. Depending on how long a recession lasts and how deeply unemployment penetrates the workforce, there may be more home mortgage foreclosures than there were in the recession of the early 1980s, because more households may be overextended financially. Home equity loans may be more or less a problem, depend-

ing on how prevalent they are. If interest rates can be kept in check, adjustable rate mortgages may not become an insupportable burden. Again, the extent of any problem in this connection would depend on how many households are affected and we cannot gauge this. Families have employed various coping strategies such as taking in student-boarders or others to make ends meet. In the last recession, the market for re-sale housing was strong enough here that creditors seemed to avoid the problems of accumulating inventories of those units that had to be repossessed as a last resort.

If the values of existing housing stock do not continue to escalate as rapidly as they have been doing, it is not very likely they will drop significantly unless a real depression occurs. A lot has to do with how well off this area around the nation's capital is relative to other parts of the country. Worsening of the dire economic difficulties of West Virginia, for example, could drive people in ever-larger numbers from that state to Montgomery County in search of any livelihood they can find.

Pressures for families to double up, especially in larger, older dwelling units — with or without conversions under necessary permits — could enable current prices to be sustained. As in the mid-1970s and early 1980s, young couples or extended families may once again buy houses jointly, with the intention of moving into separate households and individual units when economic conditions improve.

Another coping mechanism of individuals laid off in the late 1970s and recessionary early 1980s was start-up of home-based businesses and consulting work. For some it was a temporary expedient; for others, the first step in creating a business enterprise that has flourished and grown.

In difficult times, Montgomery County's accessibility within a highly diverse market for goods and services, offers opportunities for the self-employed and intermittently employed to piece together supplementary income.

Unless economic conditions become truly catastrophic, impacts on tax revenue are thus not very likely to result from downward reassessments to reflect falling residential property values. More likely would be a reduction in revenue yield from high-value properties as their owner-occupants come of age to enjoy the benefits of the "circuit-breaker" tax exemption.

Impacts on the Development Pattern

None of this is to suggest that the outward spread of the metropolitan area will be stemmed. Development in outlying jurisdictions beyond Montgomery County will certainly continue. Land is available. Prices are lower than here, and constraints imposed by regulation and tastes of existing neighbors are fewer. Large tracts are already committed to projects targeted for housing for young families who will be suburban com-

muters to jobs in Montgomery County and other metropolitan jurisdictions. They will also attract low density employment uses that are highly sensitive to land price and labor cost but do not require high accessibility to the centers of government and commerce.

Except for locations near to MARC train stations, this fringe development will be characterized by virtually total automobile dependency.

Impacts on Traffic Congestion

The question has been raised whether any elements in the economic recession scenario promise relief from traffic congestion.

Among the working papers of the Commission on the Future is one which discusses the potential benefits of the federal government actively collaborating in the County's transportation management efforts. The prospect of federal relocation, consolidation and efficiency measures in Montgomery County may offer such an opportunity. A serious federal commitment to

improving air quality in this area could point in the same direction.

As the County's single largest employer,¹⁸ federal government is in a position to help alter Montgomery County's work-trip traffic patterns dramatically through its location choices and transportation management activities. Indeed, the extraordinary success of the Nuclear Regulatory Commission's measures, undertaken in cooperation with the County DOT's transportation management program, far surpasses the achievements any private sector effort has yet demonstrated. Through a well-designed incentives-disincentives package, NRC has been able to induce 58 percent of its employees to make their work trips by means other than single-occupant automobile, an unprecedented modal split in a suburban community.

Impacts on Citizen Sentiment

Today, there appears to be some ground-swelling of anti-development sentiment among citizens. Concern

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- 18 Federal jobs (civilian and military) comprise 12-13 percent of the County's "at place" employment, according to the Montgomery County Planning Department's staff report, *Trends & Forecasts: Jobs, Housing, Population & Births*, December 1987. National Capital Planning Commission figures do not anticipate decrease in the County's complement of federal workers.
- 19 Montgomery County, Maryland, Office of Management and Budget and The Survey Research Center and Institute for Government Service, University of Maryland, *Montgomery County Citizen Evaluations and Perceptions: An Opinion Survey*, September 1987, 31 ff.
- 20 Arthur Spengler, Montgomery County Council Staff Director, op. cit., p. 20. These figures exclude parking district taxes and penalty/interest collections. Real per household property tax collections were \$2,246 in FY 1978, dropped to \$1,796 in FYs 1982-83 and have also risen, although not to the same level as in days of TRIM.

about the pressure of rising taxes and stressful traffic congestion leads people to question the relative benefits and costs of rapid-paced development. Although the majority of citizens questioned in the County Office of Management and Budget biennial survey of June 1987¹⁹ said they would favor a tax increase for higher levels or quality of service they were focusing on upgrading their own quality of life rather than investing to support additional job creation or accommodate additional housing. The sorts of improvement seen by the largest numbers to justify additional tax burden were congestion-easing road construction, expanded facilities for elderly day care, smaller class sizes in the public schools and more child day care facilities.

These were answers of people already housed with a high degree of satisfaction, in a context of full employment, rising real incomes and property taxes that had dropped, in relation to household income, to the lowest point since 1978.

On a per capita basis, real property taxes (i.e., adjusted to account for inflation)²⁰ were \$771 in FY 1978, the year of TRIM. They dropped to \$664 in FY 1982 and

have risen steadily to the present, when they are once more back to the FY 1978 level.

Returning to the experience of the early 1980s, households feeling the strain of interrupted incomes or job insecurity could very well revive a citizen tax resistance movement. Without the prospect of federal support for costly road projects, especially, the heavy burden of financing will fall on state and local taxes. The result will probably be, once again, pressure on County government to cancel or defer many capital works spending projects.

A major recession that puts many County residents out of work and seriously threatens the income security of many others might, however, dissolve some of the currently expressed anti-development sentiment. The desirability of undertaking public works projects as job creation measures would be enhanced. Further, labor costs of implementing such projects may be less than at times when full employment puts an extra premium on wages and salaries.

A period of respite from the explosive pressures of growth could mean an opportunity for the County to start catching up with the backlog of needed capital

19 Montgomery County, Maryland, Office of Management and Budget and The Survey Research Center and Institute for Government Service, University of Maryland, Montgomery County Citizen Evaluations and Perceptions: An Opinion Survey, September 1987, 31 ff.

20 Arthur Spengler, Montgomery County Council Staff Director, op. cit., p. 20. These figures exclude parking district taxes and penalty/interest collections. Real per household property tax collections were \$2,246 in FY 1978, dropped to \$1,796 in FYs 1982-83 and have also risen, although not to the same level as in days of TRIM.

projects, preparing the way for resuming development once the economy recovers.

Under any circumstances, the County will indubitably be forced to maximize cost-effectiveness of those projects that do go forward.

Implications for the General Plan

Such prospects strengthen the arguments in favor of maintaining a compact pattern of development concentrated around major transportation infrastructure. Opening broad new land areas for development will only mean spreading limited resources more thinly.

The capital spending constraints implied by the recession scenario call for increased densities, transportation demand management programs, more ridesharing and bigger modal splits for transit. All mesh well with concerns about the foreign exchange costs and national security risks associated with petroleum import dependency. All mesh with current public health concerns about air quality and longer-term global warming. And all conflict with market demands for lifestyles that breed ever-greater automobile dependency and opposition to changes in the classic suburban neighborhoods that County citizens find desirable.

Concluding Note

Montgomery County's Annual Growth Policy and Adequate Public Facilities Ordinance were instituted out of concern about infrastructure capacities and standards of service. They may also prove to be a cushion for the County in times of recession. By bringing the flow of development into alignment with the pace of expanding infrastructure, the AGP/APFO mechanism can offer the County some protection against becoming over-extended. Depending on how the mechanism is used, it also has the potential for modulating local impacts of the larger economy's cyclical peaks and valleys.

The future may well bring some serious economic dislocations. But Montgomery County is in a much better situation to deal with them than many another jurisdiction that has not made similar efforts to build a diverse economic base and manage its growth. The General Plan and economic development strategies may need some revisions to accommodate the fact that development has pushed the lower cost suburban fringe to Montgomery County's northern and eastern borders and beyond. But the solid core of planning policy and principles embodied in the General Plan has served the County well through times of prosperity and it promises to hold up well in adversity also.

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Consultant Credits

Name of Firm	Nature of Work
COMSIS Richard Kuzmyak C. Y. Jeng Ron Malone Richard H. Pratt	Transportation Modeling
DeLeuw, Cather and Company Clarke Rees	Transportation Analysis and Cost Estimating
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